National Response Team

Technical Assistance for Anthrax Response

Interim-Final Draft for Review
June 2002

The National Response Team

The National Response Team (NRT) comprises 16 federal agencies that have major responsibilities in environmental protection, transportation, emergency management, worker safety, and public health. The Clean Water Act[1] (CWA) provides the authority for the establishment of the National Response System, which contains the NRT, Regional Response Teams (RRTs), and On-Scene Coordinators (OSCs). The RRTs, organized into 13 regions, ensure that appropriate federal and state assistance will reach an incident scene quickly and effectively when needed. The OSCs coordinate or direct response resources and efforts during a pollution incident. The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes the specific roles and responsibilities of the NRT and RRTs. The NCP implements legislative authorities including the CWA, as amended by the Oil Pollution Act of 1990; the Comprehensive Environmental Response, Compensation, and Liability Act; and the Emergency Planning and Community Right-to-Know Act (Title III of the Superfund Amendments and Reauthorization Act). The NRT is chaired by the U.S. Environmental Protection Agency (EPA), and the U.S. Coast Guard (USCG) serves as Vice Chair. The RRTs are co-chaired by EPA and USCG.

NRT member agencies are:

- Environmental Protection Agency (Chair)
- Department of Transportation (U.S. Coast Guard) (Vice-Chair)
- Department of Commerce (National Oceanic and Atmospheric Administration)
- Department of the Interior
- Department of Agriculture
- Department of Defense
- Department of State
- Department of Justice
- Department of Transportation (Research and Special Programs Administration)
- Department of Health and Human Services
- Federal Emergency Management Agency
- Department of Energy
- Department of Labor
- Nuclear Regulatory Commission
- General Services Administration
- Department of the Treasury

The NRT is responsible for coordinating federal planning, preparedness, and significant response actions related to oil discharges and releases of hazardous substances, pollutants, and contaminants. The NRT's direct planning and preparedness responsibilities include:

[1] 33 U.S.C. §1251 et seq.

- Monitoring response-related research and development, testing, and evaluation activities of NRT agencies to enhance coordination, avoid duplication of effort, and facilitate research in support of response activities; and

- Reviewing regional responses to oil discharges and releases of hazardous substances, pollutants, or contaminants, including an evaluation of equipment readiness and coordination among responsible public agencies and private organizations.

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ACRONYMS

ACIP	Advisory Committee on Immunization Practices
APHL	Association of Public Health Laboratories
APRs	Air Purifying Respirators
AST	Atlantic Strike Team
ATSDR	Agency for Toxic Substances and Disease Registry
AVA	Anthrax Vaccine Adsorbed
CDC	Centers for Disease Control
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CONPLAN	Concept of Operations Plan
CWA	Clean Water Act
DOD	United States Department of Defense
DOE	United States Department of Energy
DOL	United States Department of Labor
DOT	United States Department of Transportation
ECOT	Emergency Communications and Outreach Team
EPA	United States Environmental Protection Agency
ESF	Emergency Support Function
FBI	Federal Bureau of Investigation
FEMA	Federal Emergency Management Agency
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FRP	Federal Response Plan
GSA	General Services Administration
HASP	Health and Safety Plan
HazMat	Hazardous Material
HAZWOPER	Hazardous Waste Operations and Emergency Response
HEPA	High-Efficiency Particulate Air
HHS	United States Department of Health and Human Services
HMR	Hazardous Materials Regulations
HVAC	Heating, Ventilation, and Air Conditioning
IATA	International Air Transport Association
IC	Incident Commander
ICS	Incident Command System
IO	Information Officer
JIC	Joint Information Center

LRN	Laboratory Response Network
NCC	National Coordination Committee
NCP	National Contingency Plan
NIOSH	National Institute of Occupational Safety and Health
NRT	National Response Team
OPP	Office of Pesticides Programs
OSC	On-Scene Coordinator
OSHA	Occupational Safety and Health Administration
PAPRs	Powered Air-Purifying Respirators
PCR	Polymerase Chain Reaction
PDD	Presidential Decision Directive
PIAT	Public Information Assist Team
PPE	Personal Protective Equipment
QA/QC	Quality Assurance/Quality Control
RRT	Regional Response Team
RSPA	Research and Special Programs Administration
TIO	Technology Innovation Office
UC	Unified Command
USCG	United States Coast Guard
USDA	United States Department of Agriculture

CHAPTER 1. PURPOSE AND SCOPE

1.1 Purpose

The purpose of this document is to help protect public health and safety by providing the most current information available throughout the federal government, and sharing national experience to date in responding to intentional releases of *B. anthracis* in urban environments. This document will be updated on a periodic basis to reflect new knowledge based on further experience and the results of relevant research. But this information is evolving rapidly, and it is difficult to keep a written document as current as it needs to be. Therefore, new information related to detection and decontamination of *B. anthracis* will be published at www.nrt.org, as soon as it is available. You are strongly urged to check that site for relevant updates before using any of the information presented here.

Technically, the term "anthrax" refers to the disease caused by *B. anthracis*, and not to the bacterium or its spores. However, in this document "anthrax" refers to the disease and to both *B. anthracis* spores and vegetative cells. Terms such as "anthrax contamination" or "releases of anthrax" are often used in this document to make it easier to read and to reflect terminology commonly used in the media and the general public.

This document was developed as a technical resource primarily for consequence management following a release of anthrax. Any suspected terrorist incident could involve additional hazards, such as explosives, chemical contamination, or radiation. It is essential, therefore, to follow normal hazardous material (HazMat) response procedures until the type and severity of the threat is fully identified.

1.2 Audience and Scope

This Technical Assistance Document is designed for a wide audience, including government agencies responding to a release on their own property or as part of a federal effort, and facility managers and owners where a release may be discovered. The document is organized as follows:

- Chapter 2, Federal Plans and Agency Roles – includes descriptions on the basic federal plans and the roles and responsibilities of the primary agencies that may be involved in response activities.

- Chapter 3, Overview of a Response – provides an overview of the activities involved in responding to a potential or confirmed anthrax release.

- Chapter 4, First Response to a Suspected Anthrax Incident – describes initial actions that should be taken if contamination is suspected, and refers to a "Quick Response Guide," (Appendix A) that can be pulled out and used during initial response to a release.

- Chapter 5, Health and Safety Considerations – includes information on worker health and safety, personal protective equipment, and medical monitoring.

- Chapter 6, Sampling and Analysis for *B. anthracis* – discusses sampling plans, objectives, approaches, methods, and interpretation.

- Chapter 7, Decontamination – describes the processes currently available for decontaminating anthrax, and factors to consider in making a selection.

- Chapter 8, Collection, Treatment, and Disposal of Wastes – discusses considerations for the collection, treatment, and disposal of wastes that result from decontamination activities.

- Chapter 9, Communications, Community Involvement, and Outreach – offers checklists and other resources to support public outreach during a response.

1.3 How to Use This Document

This document provides technical information on a wide range of activities – initial actions when a potential release is discovered, selection of personal protective equipment, evaluation of decontamination technologies, communication with the public, etc. As such, the document is not intended to be read sequentially, and not all of the material may be pertinent to all audiences. For example, building managers or local HazMat teams would probably be most interested in Chapter 4 (which discusses first response to potential contamination), while sampling technicians will probably focus on Chapter 6 (which discusses sampling plans and procedures). An attempt was made to provide the information in each chapter in a style and level of technical detail suitable to the most likely audience.

As mentioned above, knowledge on anthrax response is evolving rapidly, and each situation is unique. Some buildings have been contaminated with large volumes of spores dispersed through the air. Others have very localized contamination resulting from secondary contact with contaminated mail. As a result, this document does not prescribe specific actions that should be taken in every case. Rather, the document provides scientific background and viable options for responders to consider in addressing the specific circumstances that they face. The information in this document is not "applicable" under the Comprehensive Environmental Response and Liability Act (CERCLA or Superfund), but it may be "relevant and appropriate."

1.4 How this Document was Developed

The National Response Team (NRT) is responsible for national response and preparedness planning, for coordinating regional planning, and for providing policy guidance and support to the Regional Response Teams (RRTs). The NRT may consider and make recommendations to agencies on the training, equipping, and protection of response teams and necessary research, development, demonstration, and evaluation to improve response capabilities.

As a result of the recent anthrax incidents, the NRT agreed that national, interagency technical assistance is critical to effective, timely, and safe response to releases of *B. anthracis* and other biological agents. To meet this need, the NRT formed a working group that is chaired by the U.S. Environmental Protection Agency (EPA), and includes technical and scientific experts from the U.S. Department of Health and Human Services' (HHS) Centers for Disease Control and Prevention (CDC), Agency for Toxic Substances and Disease Registry (ATSDR), and National Institute of Occupational Safety and Health (NIOSH); the U.S. Department of Labor's Occupational Health and Safety Administration (OSHA); and the U.S. Coast Guard (USCG).

Concurrent with development of this document, the NRT and U.S. Postal Service formed the National Coordinating Council (NCC), which is an *ad hoc* interagency coordination group, under the umbrella of the NRT, designed to organize and communicate response efforts. Consistent with its mission, the NCC developed focused working groups of technical experts to draft the individual chapters in this Technical Assistance Document, and ensured that the information presented reflects federal experience in responding to anthrax.

CHAPTER 2. FEDERAL PLANS AND AGENCY ROLES

TO BE ADDED

CHAPTER 3. OVERVIEW OF A RESPONSE

A suspected release of anthrax triggers certain technical response actions, as outlined in the figure below. The major steps include:

- Discovery and notification – Anthrax contamination is suspected. Appropriate authorities are notified. If suspicion is strong, the area is evacuated and secured. See Chapter 4.

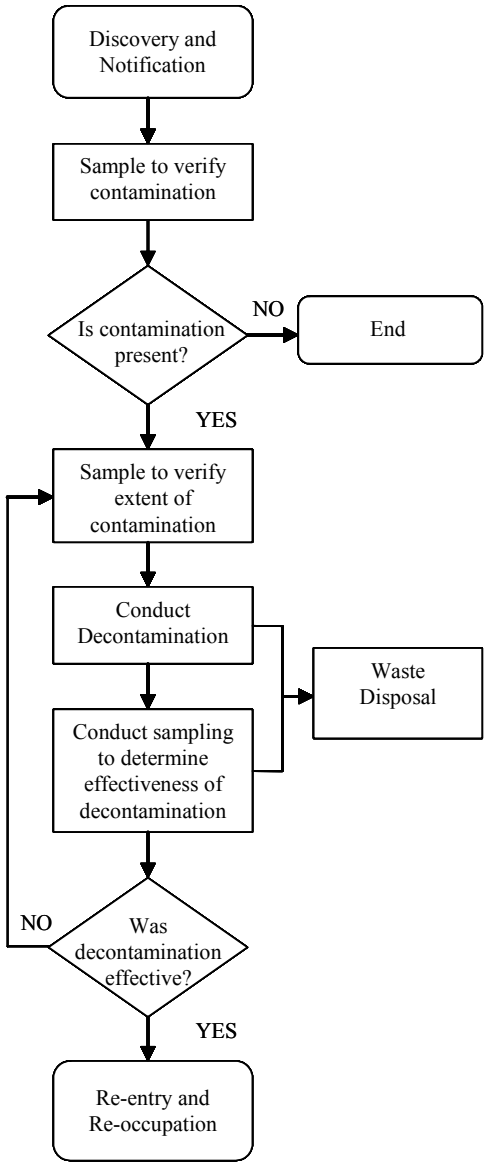
- Site assessment and initial sampling – The site is assessed. The FBI evaluates the potential crime scene and initial sampling is then done with law enforcement oversight to verify presence of anthrax. See Chapter 6.

- Defining extent of contamination – Once the FBI releases the crime scene and the presence of anthrax is confirmed, the area is secured and comprehensive sampling is done to define the nature and extent of contamination. See Chapter 6.

- Decontamination – Affected areas are isolated. Appropriate technologies are selected and used to decontaminate affected areas and items to make them safe for reuse. See Chapter 7.

- Confirming effectiveness of decontamination – If decontamination is effective, the affected area is released for re-occupancy. If decontamination is not effective, further decontamination is needed. See Chapters 6 and 7.

- Waste Disposal - Wastes should be treated on-site to reduce spores, then properly packaged and transported to a state-approved waste treatment facility. See Chapter 8.



Other activities that will take place throughout the process outlined above include ensuring worker health and safety (for both responders and employees of an affected facility) and communicating with stakeholders (e.g., the community, facility workers, the media). These are addressed in Chapters 5 and 9, respectively.

It is also the responsibility of the Incident Commander to identify local, state, and federal regulatory issues that may affect the progress of the response. At the local level, these may include issues such as traffic control, impacts on publicly-owned treatment facilities and other utilities, and building codes and permits. State-level issues might include various environmental impacts and permits, worker safety, waste transportation, and impacts on public health. The Incident Commander should contact relevant agencies to identify and address these issues as early in the response as possible. Future revisions of this document will provide more specific details on these types of potentially applicable requirements and how to deal with them.

CHAPTER 4: FIRST RESPONSE TO A SUSPECTED ANTHRAX INCIDENT

TO BE ADDED

CHAPTER 5. HEALTH AND SAFETY CONSIDERATIONS

The purpose of this chapter is to provide an overview of health and safety considerations for workers and other individuals potentially exposed to *B. anthracis*. These include both short-term response workers (e.g., emergency medical personnel, police, and firefighters) and long-term response workers (e.g., environmental response team members and decontamination workers). Certain elements of the chapter also apply to non-responders such as occupants, employees, or visitors at a site potentially contaminated with *B. anthracis.*

This chapter is organized as follows:

- Section 5.1 describes the elements of a Health and Safety Program (HASP). A template for a model HASP can be found at http://www.dupaix.com/osha/anthrax/ehasp/.

- Section 5.2 provides information regarding training under OSHA's Hazardous Waste Operations and Emergency Response (HAZWOPER) standard (29 CFR 1910.120).

- Section 5.3 provides an overview of PPE, including personnel decontamination. Appendix B provides sample PPE ensembles for different scenarios.

- Section 5.4 discusses a medical program for responders, employees, and others who may be exposed.

Information provided in this chapter should be used in conjunction with any applicable OSHA standards. See http://www.osha.gov for more information.

5.1 Health and Safety Plans (HASP)

With rare exceptions (i.e., when OSHA does not have jurisdiction), OSHA's HAZWOPER standard (29 CFR 1910.120) applies to each of the employers of the workers involved in an anthrax-related response (e.g., agencies employing emergency responders, decontamination contractors, employers at the contaminated facility, and government agencies providing oversight and assistance). For cleanup operations, this standard requires a written HASP, which identifies site hazards and appropriate controls to protect employee health and safety. The elements of the HASP are described in the standard and include the following:

- Organizational Structure,
- Site Characterization and Job Hazard Analysis (See 29 CFR 1910.132),
- Site Control,
- Training,
- Medical Surveillance,
- Personal Protective Equipment (PPE),
- Exposure Monitoring,
- Heat Stress,

- Spill Containment,
- Decontamination,
- Emergency Response, and
- Standard Operating Procedures (SOPs)

In general, a site plan is organized as a single document, with component sections and appendices covering all tasks, operations, and contractor/subcontractor issues. A site plan also promotes efficiency and enhances completeness, clarity, and coordination among all affected parties.

An electronic template for preparing a HASP for response to anthrax contamination can be found at http://www.dupaix.com/osha/anthrax/ehasp/. Due to overlap of some of the elements, it may be useful to expand the HASP to include those elements necessary to protect the local community and environment (e.g., disposal of waste from decontamination, monitoring community exposures to fumigants).

5.2 Training

A site-specific training program ensures that workers receive the hazard awareness training they need to work safely. Training should be based on the job hazard analysis in the HASP and other applicable standards, such as those listed below. Additional information regarding training is provided in Chapter IV of the model HASP.

Emergency Response

The five levels of training for employees who initially respond to an emergency are listed from the lowest to highest level of competency below.

- First Responder awareness level
- First Responder operations level
- Hazardous Materials Technician
- Hazardous Materials Specialist
- On-scene Incident Commander

Each level requires employers to have sufficient training or to have sufficient experience to objectively demonstrate competencies listed in 29 CFR 1910.120(q)(6). Certification of training is required.

Cleanup Operations

At sites where OSHA's HAZWOPER standard applies, the safety and health training program should be based on the job hazard analysis in the HASP and other relevant OSHA requirements. The training elements required by HAZWOPER include:

- Initial anthrax hazard awareness training for site workers and supervisors,
- Exceptions to initial training requirements,
- Site-specific anthrax hazard awareness briefings for visitors and workers,
- Refresher training,
- Qualification of trainers,
- Training certification, and
- Emergency response training.

All employees who work on a HAZWOPER cleanup site (not limited to cleanup crew) where they are exposed to hazardous substances, health hazards, or safety hazards, must have training that meets the requirement of 29 CFR 1910.120(e) or have equivalent experience and/or training. The four levels of training for employees who work on cleanup operations are listed below:

- General site workers,
- Workers on site only occasionally for a specific limited task (unlikely to be exposed over limits and not required to wear respirators),
- Workers regularly on site in monitored and fully characterized task areas (unlikely to be exposed over limits and not required to wear respirators), and
- Managers and supervisors.

Each level requires employees to have sufficient training or to have equivalent experience. Certification of training is required.

The required elements of training are:

- Names of personnel and alternates responsible for site safety and health,
- Safety, health and other hazards present on the site,
- Use of PPE,
- Work practices by which the employer can minimize risks from hazards,
- Safe use of engineering controls and equipment on the site,
- Medical surveillance requirements including recognition of the symptoms and signs that might indicate exposure to hazards,
- Contents of the site safety and health plan including:
  - Decontamination procedures in accordance with 29 CFR 1910.120(k);
  - An emergency response plan meeting the requirements of 29 CFR 1910.120(l) for safe and effective responses to emergencies including the necessary PPE and other equipment;
  - Confined space entry procedures; and
  - A spill containment program meeting the requirements of 29 CFR 1910. 120(j).

Post Emergency Cleanup

Where the cleanup is done on plant property using plant or workplace employees, these employees must have completed the training requirements of the following:

- Emergency action plan 29 CFR 1910.38(a),
- Respiratory protection 29 CFR 1910.134,
- Hazard communication 29 CFR 1910.1200, and
- Other appropriate safety and health training made necessary by the tasks that are expected to be performed (i.e. PPE and decontamination procedures).

Appropriate Safety and Health Training

A site-specific training program ensures that workers receive the training they need to work safely. Workers must receive all training required by applicable OSHA standards. This training may be included in the HAZWOPER curriculum. Examples of relevant training required by other standards include:

- Hazard communication
- PPE
- Respiratory protection
- Fire extinguisher
- Emergency action plan
- Fire prevention plan
- Emergency response
- Lockout/tagout
- Observing working surfaces
- Noise

Anthrax-specific hazard awareness training should help workers understand the health hazards of anthrax and how to protect themselves from exposure to spores. Specific topics might include:

- How workers might be exposed to spores, the signs and symptoms of infection, and medical conditions that could place them at increased risk (e.g., compromised immune systems);

- Where contamination has been identified in the facility, and the status of decontamination of those areas; and

- How to minimize the risk of disease through specific standard operating procedures and controls (e.g., engineering controls, work practices, housekeeping, or PPE), and whether specific measures are expected to be temporary or permanent.

There are additional training requirements for workers preparing contaminated materials or other hazardous materials for transportation to a treatment or disposal facility. These requirements can be found in the federal hazardous materials transportation regulations at 49 CFR Part 172, Subpart H.

5.3 Personal Protective Equipment (PPE)

PPE shields or isolates workers from health and safety hazards in the workplace. In a site where anthrax spores may be present, PPE protects workers from exposure to respiratory and skin hazards and prevents the spread of contaminants to uncontaminated areas. PPE can also be used to protect workers from additional hazardous substances such as those being used for the decontamination process. However, PPE is not a substitute for sound engineering, work practice, or administrative controls. PPE complements these controls to protect employee health and safety in the workplace.

Personnel entering an area known or suspected to be contaminated with *B. anthracis* spores must wear the appropriate level and type of PPE. The level and type of PPE should be based on the job hazard analysis in the HASP. Use of excessive PPE may actually increase a worker's risk of injury or illness through heat stress, accidents caused by tripping or limited vision, and difficulty communicating with other workers. Because conditions will vary from site to site, specific PPE requirements should be specified by the IC and outlined in the on-site HASP. Appendix B of this document, "Example PPE Ensembles," provides further information on the level and types of PPE to use in specific situations. Additional information regarding hazard assessment and PPE selection is provided in 29 CFR 1910.132, available at http://www.osha.gov/OshStd_data/1910_SUBPART_I_APP_B.html.

Workers should be trained to know when PPE is necessary, what type to use, how it should be worn, what its limitations are, and how long it is likely to last. They should also know how to properly maintain and dispose of it. If more than one type of PPE will provide adequate protection, employers may choose the type they prefer. Employers should certify in writing that the training has been provided and that employees understand what they need to know about PPE. The certification should show the name of each employee trained and the dates and types of training provided.

In addition, appropriate personnel decontamination and contamination containment procedures are needed for workers using PPE to prevent exposure to anthrax. In general, these procedures are similar to those for asbestos abatement, and include isolating contaminated areas, negative pressure ventilation, a three- or five-stage decontamination line with a shower for equipment and personnel, and appropriate waste disposal. For additional information, see EPA's publication "Guidance for Controlling Asbestos-Containing Materials in Buildings."

5.3.1 Skin Protection

Wearing protective clothing not only protects the skin but also can prevent the transfer of contamination off-site. Based on the conditions at the site, the IC or the site health and safety officer should determine the appropriate level of skin protection, which should also be outlined in the HASP. Tyvek or equivalent coveralls should be used as a minimum level of protection. It is important to remember that in addition to protection from contact with spores, PPE must also protect the worker from contact with chemicals used in the response.

Unpowdered disposable gloves made of lightweight nitrile or vinyl protect the hands. A thin cotton glove may be worn inside a disposable glove to protect against dermatitis, which may occur from prolonged exposure of the skin to moisture caused by perspiration.

5.3.2 Respiratory Protection

Since airborne spores generally pose the greatest threat to personnel, respiratory protection is a necessary component of the PPE program. The OSHA respiratory protection standard (29 CFR 1910.134) requires that employers establish and maintain an effective respiratory program and that employees must comply with the program. Requirements include program administration, worksite-specific procedures, respirator selection, employee training, fit testing (e.g., with irritant smoke), medical evaluation, and respirator use, cleaning, maintenance, and repair.

To date, experience has shown that powered air-purifying respirators (PAPRs) with P100 filters or full-face negative pressure air purifying respirators (APRs) with N95 filters provide adequate protection for most response, sampling, and decontamination activities involving spores. Some emergency response operations may require that first responders wear a Self-Contained Breathing Apparatus (SCBA) as part of their normal HazMat response ensemble. Refer to Chapter 4 for more information.

There may be cases where the use of respirators is desired by workers but not required for adequate protection. This voluntary use is allowed but it is subject to requirements under OSHA's respiratory protection standard (29 CFR 1910.134).

5.4 Medical Program

In addition to medical surveillance programs required in the HAZWOPER and respiratory protection regulations, the occupational health and safety plan should include the following three major components:

- Medical measures to prevent anthrax,
- Medical screening and follow-up care for anthrax and medical complications related to preventive measures, and
- Knowledge and information that workers need to prevent anthrax and medical complications related to preventive measures.

This section will address the following three types of workers or others who may be exposed to anthrax:

- Short-term response workers whose exposures are limited to a single episode or a few episodes within a brief period (e.g., fewer than 30 days). Local emergency medical

personnel, police, and firefighters who are not expected to re-enter contaminated areas for longer periods of time fall into this category.

- Long-term response workers who have repeated exposures over longer periods of time (e.g., 30 days or more). Environmental response team members and decontamination workers fall into this category. They may work at multiple sites (e.g., industrial hygienists conducting environmental sampling) or at a single site (e.g., contractors performing decontamination work).

- Occupants, workers, or visitors at a site where a case of anthrax has been identified or where environmental sampling has shown contamination with *B. anthracis* spores. For example, postal or office workers or maintenance and housekeeping personnel would fall into this category.

Section 5.4.1 addresses both short- and long-term response workers. Section 5.4.2 addresses persons who are not response workers, but are occupants, workers, or visitors at a site that is known or highly suspected to be contaminated with spores.

5.4.1 Response Workers

Response workers should already be covered by a medical program that is part of a broader occupational health and safety program. For example, emergency medical personnel, police, and firefighters are covered by occupational health and safety programs specific to their duties, some of which may involve response to hazardous material incidents. Hazardous waste operations and emergency response workers are covered by OSHA's HAZWOPER standard. However, typical medical programs for responders do not address medical considerations specific to anthrax, such as spore survival, incubation and germination, the rapidly progressive course of inhalational anthrax, the need for medical preventive measures, and at-risk workers who are exposed for fewer than 30 days.

The medical program for response to anthrax should be designed and administered under the supervision of a licensed physician in conjunction with a health and safety officer. The supervising physician should be knowledgeable about all of the relevant areas of occupational medicine (e.g., toxicology, industrial hygiene, medical screening, and occupational health surveillance) and should be able to appropriately interpret and use information about potential exposures, PPE, work schedules, work practices, and relevant regulations.

Because work sites for long-term response workers may be far from the home-base or permanent duty station, health care providers implementing the program should be selected for accessibility to workers, diagnostic resources, a reliable system for hospital referral, and around-the-clock coverage for work-related medical care. The supervising physician should be routinely informed about non-emergency matters and contacted immediately for high-dose exposures, medical emergencies, and any issues not covered in the provider's contract. Release of information for occupational health and safety purposes is subject to legal requirements for confidentiality. For

example, confidentiality of medical information should be maintained when notifying an employer of an individual worker's fitness for duty. Each worker should be notified of the results of his or her own evaluation. Employers and workers should be informed of group findings and related recommendations.

5.4.1.1 Medical Measures to Prevent Anthrax

Despite the use of PPE, response workers may be at risk for exposure to *B. anthracis* spores because PPE is not 100% protective, work practices may be inadequate, and breaches in PPE and environmental controls may occur. It is not yet known how many spores cause inhalational anthrax or how many spores a responder may be exposed to during environmental sampling or decontamination activities. Because of this uncertainty and because inhalational anthrax is potentially fatal, workers entering areas that are known or highly suspected to be contaminated should be adequately immunized with anthrax vaccine or placed on appropriate prophylactic antibiotics, even though there may be some negative side effects from these medical measures. This recommendation also applies to workers entering areas that have been decontaminated but are not yet cleared for general occupancy. Use of PPE and other protective measures are still required for entry into uncleared areas.

To prevent inhalational anthrax, response workers should begin antibiotic prophylaxis at the time of their first exposure and continue for 60 days after their last exposure. Experimental data indicate that viable spores may persist in the lungs for 100 days after exposure. Therefore, an option is the use of antibiotics from the first through the last days of anthrax work and for 100 days thereafter (i.e., 40 days longer than course described above).

Response workers who repeatedly enter contaminated sites over a prolonged period of time (e.g., field investigators, inspectors, and decontamination workers) will need to use antibiotics for considerably longer than the 60 days recommended for persons with a one-time or short-term exposure. Prolonged antibiotic use may have some negative side effects and may also lead to the development of resistant microorganisms. The Advisory Committee on Immunization Practices (ACIP) has unpublished recommendations that personnel with high risk of repeated exposures be immunized with anthrax vaccine prior to exposure. These recommendations would apply to long-term response workers. As of February 2002, however, there are limited supplies of licensed anthrax vaccine adsorbed (AVA) available for civilian use are limited. As additional supplies of AVA become available, response workers with the highest likelihood of repeated exposures for prolonged periods should be considered candidates for immunization. AVA is licensed for the pre-exposure administration of a 6-dose series (at 0, 2, and 4 weeks, 6, 12, and 18 months) with annual boosters thereafter. If the vaccine series is started after exposure has occurred, antibiotic prophylaxis should be continued during the first three doses to provide protection until the development of an adequate immune response.

5.4.1.2 Medical Screening, Monitoring, and Follow-Up Care

The purpose of occupational health surveillance in the workplace is to improve the effectiveness of the occupational health and safety program by systematically collecting and analyzing information that pertains to at-risk workers. Examples of useful information include the results from a medical screening program, a medical monitoring program for adverse work-related health effects, and exposure monitoring (e.g., incidents of breaches in PPE). Such information should be provided in a timely manner to the supervising physician for analysis and interpretation. The results of occupational health surveillance can be used to determine the need for additional screening or other precautions needed to protect worker health and safety.

Medical screening is the use of examinations or tests to detect adverse effects on a worker's health at an early stage when prevention is possible or treatment is most effective. Baseline medical screening should identify pre-existing conditions that may affect an individual worker's fitness for duty. The physical demands of the work and the PPE selected should be considered, as well as potential health effects (e.g., heat stress, dehydration, claustrophobia, and aggravation of heart, respiratory, and skin conditions). The initial medical screening should also identify workers who should avoid antibiotics or vaccines. Workers should be evaluated periodically to reassess fitness for duty and to detect symptoms of the development of anthrax or adverse effects related to preventive measures. When it is no longer necessary for a worker to re-enter a contaminated site, a final evaluation should be done to identify changes from the baseline and any new risk factors.

There are no validated methods for monitoring a person's exposure to *B. anthracis*. Nasal swabs and serology may be useful as epidemiologic tools, but should not be used to assess a person's exposure or to make decisions about the use of antibiotics or vaccine.

The medical monitoring program for adverse effects related to antibiotic use should include plans to inform affected workers about available options for preventing anthrax and the risks and benefits of each option. The goal is an informed decision appropriate for the affected individual.

Negative environmental sampling results in areas with no known anthrax cases (e.g., investigations of hoaxes) or in decontaminated areas that have been cleared for occupancy may justify discontinuation of antibiotic prophylaxis only if the individual worker had no previous exposure in areas known or highly suspected to be contaminated with *B. anthracis* spores.

Inhalational exposure to a high concentration of *B. anthracis* spores may rapidly result in death. Therefore, exposure to aerosolized powder known or highly suspected to be contaminated with *B. anthracis* spores should be treated as a medical emergency.

Medical follow-up for response workers should be provided as long as the risk for inhalational anthrax exists, whether the worker is onsite, off duty, on travel, or no longer working at the contaminated site. Special arrangements may be necessary for following out-of-town workers after they leave the worksite.

Recommendations for medical screening, monitoring, and follow-up care of response workers are summarized in Table 5-1 and Table 5-2.

5.4.1.3 Knowledge and Information

HAZWOPER training requirements are described above in Section 5.2. Response workers will also need additional knowledge and information about anthrax and the medical measures that can protect them. All response workers should be trained to recognize and report early symptoms and signs of anthrax, understand the importance of immediate medical attention, and know how to access emergency medical care. Workers on antibiotics should be educated about potential adverse effects and interactions with food and drugs. If vaccine is used as a preventive measure, workers should be educated about the potential adverse effects of vaccine and the amount of time necessary to develop an immune response. It should be stressed that for preventive measures to be effective, individual workers must fully understand them and use them correctly – merely receiving information or training alone may not be sufficient.

5.4.1.4 Summary

Despite the apparently low rate of disease after exposure, a high level of protection is warranted for response workers at anthrax-contaminated sites. Inhalational anthrax is rapidly progressive and highly fatal, PPE use does not guarantee 100% protection, and the risk for developing disease cannot be adequately characterized. These recommendations go beyond HAZWOPER requirements and include:

- Recommendations for response workers with fewer than 30 days of exposure,
- Treating inhalation exposure to high concentrations of spores as a medical emergency,
- Post-assignment medical follow-up as long as the risk of inhalational anthrax exists or a worker is on antibiotic prophylaxis,
- Post-response tracking of a highly mobile workforce, and
- Assurance that workers understand the need for immediate medical attention should symptoms of inhalational anthrax occur.

When a licensed anthrax vaccine is available, it will decrease the reliance on antibiotics for the prevention of inhalational anthrax. Mandatory measures should include both a medical measure (i.e., antibiotic prophylaxis or immunization) and measures to reduce exposure (i.e., use of adequate PPE and environmental controls).

5.4.2 Occupants and Visitors at Contaminated Sites

Occupants and visitors at a site where a case of anthrax has been identified or environmental sampling has confirmed contamination may be at risk for developing anthrax. This may include both individuals who worked at the site between the initial incident and its subsequent discovery and containment, or who continue to work at a site where the known contaminated area has been isolated from the rest of the work site but where decontamination and verification processes are

Table 5-1. Medical Screening, Monitoring, and Follow-Up Care for Anthrax-related Response:[1] Fitness for Duty[2,3] and Medical Clearance to Use Personal Protective Equipment and Clothing (PPE)[2,4]

Information Needed by Supervising Physician	Considerations	Type of Evaluation	Features	Time of evaluation
From site health and safety officer: - Site-specific occupational health and safety program (e.g., respiratory protection program, heat stress prevention, worker training) - Job tasks and work practices - Work schedule (e.g., work-rest schedule, job task rotation, shift work, days off) - Description of selected PPE - Temperature and humidity of work environment	- Previous work at hazardous waste sites - Conditions affecting performance of job tasks - Conditions affected by shift work or prolonged workshifts - Conditions affecting proper use of PPE - Conditions aggravated by use of PPE	Complete medical and occupational history	Special attention to medication use; metabolic, cardiovascular, neurologic, respiratory and musculoskeletal conditions; heat and cold intolerance; latex/rubber sensitivity; conditions aggravated by dehydration, heat stress, physical exertion, and prolonged workshifts; claustrophobia	Before and at end of assignment
		Complete physical examination	Special attention to visual, auditory, respiratory, cardiovascular, musculoskeletal, and nervous systems; presence of facial hair and/or deformities	Before and at end of assignment
		Medical tests	Chest x-ray, electrocardiogram, spirometry	As indicated
			Blood glucose, hemoglobin, liver function tests, kidney function tests, and other clinical laboratory tests	
	- Conditions affecting ability to see and hear warning signals	Visual and audiological screening	- Visual acuity, refraction, depth perception, peripheral vision, color vision - Audiometry	Before and at end of assignment
- Specific hazardous agents at the worksite (e.g., decontamination agents) - Applicable OSHA standards (*3,4*\t)	- Target organs - Predisposing conditions	Medical screening examinations	Examples: for chlorine dioxide, focus on respiratory system and eyes; for paraformaldehyde, focus on the skin, eyes, respiratory system, and allergic condition	As indicated

FOOTNOTES to Table 5-1

1. These recommendations are not exhaustive. The following references provide more complete information. If a hazardous waste worker is employed for decontamination activities, a recent evaluation may be used with an update to take into consideration newly developed health conditions and site-specific needs.

2. NIOSH, OSHA, USCG, US EPA [1985]. Ch. 5. Medical program. In: Occupational safety and health guidance manual for hazardous waste site activities. Washington, DC: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 85-115, pp. 5-1–5-10. http://www.cdc.gov/niosh/pdfs/85-115-a.pdf.

3. See Occupational Safety and Health Administration (OSHA) regulations for the medical evaluation of respirator users in the standard for respiratory protection: 29 CFR 1910.134(e) [1998]. In: Code of Federal Regulations. Washington, DC: U.S. Government Printing Office, Office of the Federal Register. http://www.osha-slc.gov/OshStd_data_1910_0134.html. The questionnaire for the medical evaluation can be found at: http://www.osha-slc.gov/OshStd_data/1910_0134_APP_C.html.

4. See OSHA regulations for medical surveillance of hazardous waste workers in the standard for hazardous waste operations and emergency response: 29 CFR 1910.120(f) [1996]. http://www.osha-slc.gov/OshStd_data/1910_0120.html.

Table 5-2. Medical Screening, Monitoring, and Follow-up Care for Anthrax-related Response:[1] Preventing Illness

Issues	Information Needed by Supervising Physician	Type of Evaluation	Features	Time of Evaluation
Anthrax	From site health and safety officer: - Site-specific characteristics about contamination and control measures, plans, practice, and effectiveness - Occupational health and safety program re: *B. anthracis* and anthrax	Targeted medical history about predisposing conditions	Attention to skin conditions, immunodeficiency disorders	Before assignment
		Information dissemination and counseling	Worker knowledge and understanding of: - Characteristics of disease and diagnostic difficulties - Urgent need for medical attention as soon as symptoms occur	Before and at end of assignment
		Monitoring for disease	Signs and symptoms of inhalational and cutaneous anthrax	Throughout assignment + 100 days afterward
Post-exposure antibiotic prophylaxis	From CDC and FDA: - Recommendations for antibiotic prophylaxis	Targeted medical history	Drug allergies, medication use, problems with prior use of antibiotics, pregnancy	Before assignment
		Information dissemination and counseling	- Duration of antibiotic use, adverse effects, food and drug interactions, risk of disease versus risk of adverse drug effects - Monitoring compliance and adverse effects	While on medication
		Monitoring antibiotic use		

Table 5-2. Medical Screening, Monitoring, and Follow-up of Anthrax-related Response:[1] Preventing Illness (continued)

Issues	Information Needed by Supervising Physician	Type of Evaluation	Features	Time of Evaluation
Anthrax vaccine	From CDC, FDA, and ACIP: - Vaccine recommendations	Pre-assignment immunization status	Dates of previous anthrax vaccination	Before assignment
			If available, pre-exposure vaccine or booster as indicated	
		Information dissemination and counseling	- Local side effects: pain and swelling at site of injection - Systemic side effects (rare)	If applicable
		Medical monitoring		
Occupational Health Surveillance	From site health and safety officer: - Environmental monitoring results - Exposure incidents From health care providers of medical evaluations: - Reports of symptoms and other health outcomes	Data collection and assessment of environmental and medical information	- Level of protection - Breaches of PPE and environmental controls - Off-site sources of contamination	Throughout assignment
			- Skin lesions, symptoms of inhalational anthrax - Adverse effects of antibiotic use, compliance	Throughout assignment and for 100 days after assignment
			Evaluation of trends in workforce	

Table 5-2. Medical Screening, Monitoring, and Follow-up of Anthrax-related Response [1]: Preventing Illness (continued)

Issues	Information Needed by Supervising Physician	Type of Evaluation	Features	Time of Evaluation
Logistics	From site health and safety officer: - Workforce characteristics (e.g., geographic origins)	Arrangements for providing health care	- Indications and procedures for accessing emergency and non-emergency medical care and follow-up	Before, throughout, and for 100 days after assignment
		Information dissemination and counseling		

1. These recommendations are not exhaustive and may change as new information becomes available. The most recent information from DHHS, CDC,FDA, and ACIP should be consulted.

not yet complete. Maintenance and housekeeping personnel, whose job tasks may increase their risk for exposure, should be included in this category. The medical program for this group should have two phases: the immediate post-exposure period (5.4.2.1) and the period after a previously contaminated site has been cleared for unrestricted entry and occupancy (5.4.2.2). Medical prevention of anthrax, medical monitoring and follow-up care, and knowledge and information should be addressed.

5.4.2.1 Immediate Post-exposure Period

For exposed persons, CDC currently recommends 60 days of antibiotic prophylaxis after exposure. Because experimental data indicate that viable spores may persist in the lungs for 100 days after exposure, an option is the use of antibiotics for 100 days (40 days longer than course described above).

Initial medical screening should be done to identify exposed persons who should avoid taking antibiotics. Exposed persons should be evaluated periodically to monitor the development of anthrax or adverse effects related to preventive measures.

Inhalational exposure to a high concentration of *B. anthracis* spores may rapidly result in death. Therefore, exposure to aerosolized powder known or highly suspected to be contaminated with *B. anthracis* spores should be treated as a medical emergency.

Medical follow-up should be provided as long as the risk for inhalational anthrax exists. Contingency plans should be made for medical evaluation and care of persons with suspected cases of anthrax.

The program for monitoring exposed persons and providing follow-up care cannot be successful without at-risk individuals having adequate knowledge and information to protect themselves. Therefore, all exposed persons should be trained to recognize and report early symptoms and signs of anthrax, understand the importance of immediate medical attention, and know how to access emergency medical care. Those on antibiotics should be educated about potential adverse effects and interactions with food and drugs. It should be stressed that for preventive measures to be effective, at-risk individuals must fully understand and use them correctly – merely providing at risk individuals with information or training may not be sufficient.

5.4.2.2 Period after Clearance for Unrestricted Entry and Occupancy

Once a previously contaminated site has been cleared for re-occupancy, personal protection and medical measures to prevent anthrax are presumably no longer necessary. However, a precautionary program of medical monitoring may be prudent to assure that anthrax is no longer a threat. The program should be designed and administered under the supervision of a licensed physician. The supervising physician should be provided information about eligible persons, indicators of contamination (e.g., environmental sampling results) before and after

decontamination activities, details about activities performed to eliminate the risk of exposure, and clearance criteria for re-occupancy.

The details of the medical program should be tailored to the characteristics of the at-risk population and the specific site, but should include an initial medical history to screen for high-risk conditions (e.g., compromised immunity, skin conditions), counseling of high-risk persons, around-the-clock access to medical coverage for anthrax-like symptoms, and confidentiality of medical information. Since exposed populations have a low incidence of anthrax disease, monitoring reports of respiratory and skin conditions on a site log would be more feasible than medical screening of all potentially exposed individuals. Follow-up of prolonged illnesses may be necessary to detect cases of inhalational anthrax, should they occur.

The validity and reliability of symptom reports are only as good as the exposed person's knowledge and understanding of the characteristics of anthrax and risks for developing the disease. Successful treatment of anthrax will depend on the individual's understanding of the need for immediate medical attention should symptoms occur and knowledge of how to access emergency medical care. Therefore, hazard awareness training is an important component of the medical program.

If an exposed person is diagnosed with cutaneous or inhalational anthrax, or the site log of health symptoms reveals a rising trend, the supervising physician and the health and safety officer should immediately make an assessment to determine whether it is related to past or current exposure. Such an assessment is necessary for making appropriate decisions to protect occupants and visitors.

Recommendations for medical screening, monitoring, and follow-up care of occupants and visitors at contaminated sites are summarized in Table 5-3.

Table 5-3. Medical Monitoring and Follow-Up Care for Preventing Illness Among Occupants and Visitors at Contaminated Sites

Issues	Information Needed by Supervising Physician	Type of Evaluation	Features	Time of Evaluation
Anthrax	From site health and safety officer: - Site-specific characteristics about contamination and decontamination - Occupational health and safety program re: *B. anthracis* and anthrax - Identification of occupants and visitors	Targeted medical history about predisposing conditions	Attention to skin conditions, immunodeficiency disorders	Immediately after identification of exposure and Time of clearance for unrestricted entry into an area that has been decontaminated
		Information dissemination and counseling	Knowledge and understanding of: - Characteristics of disease and diagnostic difficulties - Urgent need for medical attention as soon as symptoms occur	
		Monitoring for disease	Signs and symptoms of inhalational and cutaneous anthrax	For 100 days after identification of exposure and clearance for unrestricted entry

Table 5-3. Medical Monitoring and Follow-Up Care for Preventing Illness Among Occupants and Visitors at Contaminated Sites (continued)

Issues	Information Needed by Supervising Physician	Type of Evaluation	Features	Time of Evaluation
Post-exposure antibiotic prophylaxis	From CDC and FDA: - Recommendations for antibiotic prophylaxis	Targeted medical history	Drug allergies, medication use, problems with prior use of antibiotics, pregnancy	Before prescribing antibiotics
		Information dissemination and counseling	- Duration of antibiotic use, adverse effects, food and drug interactions, risk of disease versus risk of adverse drug effects - Monitoring compliance and adverse effects	While on medication
		Monitoring antibiotic use		
Disease monitoring	- Reports of symptoms and other health outcomes	Data collection and assessment of environmental and medical information	- Skin lesions, symptoms of inhalational anthrax - Adverse effects of antibiotic use, compliance - Evaluation of trends	For 100 days after - identification of exposure and - clearance for unrestricted entry
Logistics	From human resource managers: - Characteristics of occupants and visitors	Arrangements for providing health care	- Indications and procedures for accessing emergency and non-emergency medical care and follow-up	
		Information dissemination and counseling		

1. These recommendations are not exhaustive and may change as new information becomes available. The most recent information from DHHS, CDC, FDA, and ACIP should be consulted

CHAPTER 6. SAMPLING AND ANALYSIS FOR *B. ANTHRACIS*

This chapter describes sampling and analysis that takes place after the crime scene is released for consequence management. Environmental sampling is an important tool for determining the presence of *B. anthracis* spores in indoor environments. Sampling can help assess the extent and degree of contamination and the risk of exposure to building occupants and responders. Sampling results also contribute to informed decisions on medical treatment and decontamination options and are ultimately used to determine the effectiveness of decontamination.

Sampling objectives must be clear before an investigator decides on the number and types of environmental samples to collect and the specific locations to sample. In other words, the investigator must know what questions the data are intended to answer. Once the sampling objectives are clearly defined, appropriate sampling strategies can be developed to capture scientifically meaningful data. As data are received and interpreted, these objectives may change, but plans can be adapted to reflect the changing needs.

Certain components are essential for successfully implementing an anthrax sampling strategy. These include properly trained personnel, suitable sample media and supplies, appropriate safety policies, and procedures for ensuring thorough record keeping, documentation, and quality assurance/quality control. It is also essential to secure potentially contaminated areas to prevent cross-contamination and dispersal of spores into the air. The value of the sample analysis results may be limited if any of these issues are not adequately addressed.

While sampling is an important tool, certain limitations must be kept in mind. Currently, there are no occupational or environmental exposure standards for *B. anthracis* contamination and no validated sampling and analytical methods specifically for *B. anthracis* in environmental samples. There are also insufficient data on the collection efficiency of various sample collection media (e.g., swabs, wipes, filters) for typical surfaces encountered in indoor environments (e.g., furniture, carpet, letters, clothing, computer screens, ventilation system filters). There have been no studies on how sample collection efficiency is affected by varying concentrations of spores mixed with particles and dust. The recovery efficiency of the analytical methods (i.e., removal of spores from the sample collection media) has not been adequately evaluated and limits of detection have not been established. Professional judgment must be used to interpret any positive or negative findings as well as quantitative or semi-quantitative results.

The first step in any sampling program is to develop a comprehensive plan. The plan can be a field-ready "boiler plate" or a unique document. This section lays out the key elements of an appropriate sampling plan.

6.1 General Sampling Plan Considerations

The purpose of a sampling plan is to create a road map to achieving defined sampling objectives. An effective sampling plan will provide confidence that the results obtained are valid and indicative of the contamination present. A sampling plan is best developed by a team that includes medical, environmental, public health, and industrial hygiene professionals who are familiar with environmental sampling methods and the public health impacts and worker safety issues related to anthrax. In developing the sampling plan, the team should also consult with representatives of local, state, and federal agencies, analytical laboratories, and facility managers familiar with the building's layout and heating, ventilation, and air conditioning (HVAC) equipment.

In evaluating methods that will achieve the sampling objectives, the team should also consider several other factors. These include:

- Laboratory capability (e.g., the laboratory's ability to handle the proposed sample media);
- Collection efficiency of the method, number of samples, and need for quantification;
- Suitability of the sampling collection and analytical methods;
- Cost effectiveness and efficiency of the sampling plan in meeting stated objectives; and
- The utility of the sampling method to the owner and/or federal agency having jurisdiction over the project.

All suspicious packages should first be evaluated for other hazards (e.g., explosives or secondary devices, chemical or radiological materials) prior to handling by sampling teams. Also, because collected samples may become evidence in a criminal case, law enforcement officials responsible for evidence should be consulted prior to starting sampling. Ideally, law enforcement and environmental responders should collaborate on the sampling plan to enhance response efficiency and effectiveness. Environmental responders are experts at environmental sampling techniques and methods and can assist in assessing forensic evidence. Additionally, data obtained from forensic evidence collection can help environmental responders define the extent of contamination. A memorandum of understanding between environmental responders and criminal investigators is being developed by the NRT and will be available at www.nrt.org when finalized.

6.2 Specific Sampling Objectives

The subsections below describe a variety of potential sampling objectives.

6.2.1 Real-time Monitoring

The sampling objective is to determine, in real-time, whether a release of spores is occurring or has occurred in a facility. Real-time instruments may be used to detect airborne biological agents as they are released. Particulates of a specific size range can be detected, analyzed, and

screened for potential biological origin. Once the particulates are confirmed to be biological, they can be subsequently collected for further analysis. The instruments are bulky and expensive and the data are often unreliable, but early detection provided by real-time meters can help reduce the spread of contamination throughout a facility.

6.2.2 Preliminary Assessment of a Facility (Screening)

The sampling objective is to determine qualitatively whether any spores are present. Typically, composite samples of large areas and air volumes are obtained to maximize the likelihood of finding contamination.

6.2.3 Identification of Spores in a Bulk Material

The sampling objective is to determine qualitatively if a bulk material, such as a powder in an envelope, is contaminated with anthrax. This type of sampling is also a tool for screening and evidence collection. Onsite analysis may be used for preliminary assessment (see limitations noted above), but formal laboratory analysis provides confirmation. If results are positive, the physical characteristics and properties of the spores will be evaluated by the analytical laboratory in conjunction with law enforcement personnel.

6.2.4 Determination of Contamination of an Article

The sampling objective is to determine whether the surface of a small article is contaminated. Typically, composite surface samples of large articles and/or individual samples of small articles are collected.

6.2.5 Extent and Location of Contamination (Site Characterization)

After anthrax is positively identified, further sampling is necessary to determine how far the contamination has spread. Sampling is performed to determine qualitatively, and if possible, semi-quantitatively, the extent and magnitude of contamination. Walls, floors, equipment, and air handling systems are examples of areas to be sampled. Results from this type of sampling are also used to establish exclusion zones for site control and decontamination.

6.2.6 Effectiveness of Decontamination (Process Verification Sampling)

The objective of post-decontamination sampling is to determine whether contamination has been successfully eliminated. As will be discussed in Chapter 7, decontamination is considered successful if post-decontamination samples show no evidence of bacterial growth when cultured. Samples are taken on previously contaminated surfaces to determine whether any viable spores remain. During fumigation biological indicators, such as spore strips, should be used to verify whether the conditions necessary to destroy anthrax spores have been achieved.

6.2.7 Post-Decontamination Sampling (Re-occupancy Verification Sampling)

Final post-decontamination sampling is conducted inside and outside of the exclusion zone to verify that the originally contaminated environment has been sufficiently decontaminated to allow re-occupancy of the area without the use of PPE. Aggressive sampling techniques should be used to maximize the possibility of detecting spores on surfaces and in the air. Aggressive sampling techniques are modeled on EPA's guidance for clearing facilities for re-occupancy after asbestos decontamination. While the area is under negative pressure, all surfaces are aggressively agitated and air is continuously disturbed while samples are collected. Aggressive sampling techniques (using fans and leaf blowers) should be done only within the confines of the exclusion zone that was established to prevent the spread of contamination. If possible, previously contaminated and subsequently cleaned HVAC systems and machinery in the area should be operating during final post-decontamination sampling.

6.2.8 Special Re-occupancy Considerations

There may be site-specific circumstances where additional sampling should be considered. For example, if portions of a facility stayed in service while an adjacent area was decontaminated, the area outside the exclusion zone might need to be re-sampled. This would confirm that the aggressive sampling techniques described above did not spread contamination beyond the exclusion barrier. Additional sampling might also be appropriate in situations where renovations could disturb potentially contaminated dust that might have been outside the exclusion zone (e.g., in rafters) or physically blocked from surface decontamination.

6.3 Sampling Approach

After the sampling objectives have been identified, a logical approach and schedule must be developed to carry out the sampling tasks.

6.3.1 Assessment/Characterization

In developing a sampling approach, a number of factors should be analyzed. These include how the spores were delivered, characteristics of the spores, and how the contamination might have spread by foot traffic, mail handling, air movement, operating machinery, and other means. The results of this analysis should indicate specific locations and surfaces to sample and whether to collect evenly or randomly spaced samples (based on statistical analyses, investigator observations or experience, or investigation goals). The sampling approach may involve a combination of sampling methods and it should be designed in a systematic manner that can be easily expanded if results show hot spots or other critical areas that need further investigation.

6.3.1.1 Targeted Sampling Strategy

If a building or area becomes contaminated from a known source and the source is quickly isolated, the sampling approach may rely heavily, if not solely, on targeted sampling. For example, during an initial investigation where there is a known or suspected release of anthrax, the first priority should be to collect samples in areas near the suspected release source(s). To determine the extent of contamination, additional samples may be taken moving outward from the suspected point of release in concentric circles. In some cases, it may be more prudent to begin sampling at perimeter locations and work inward to identify non-contaminated areas and avoid spreading contamination. The direction of the sampling scheme is dependent on the situation. Regardless of the scheme, every effort should be taken to reduce the likelihood of cross-contamination by sampling teams.

If a building or area becomes contaminated from a known source and the source is not immediately isolated, the sampling approach will still have a targeted element. However, statistical methods should be considered to offer calculated confidence in sampling results (i.e., the initial concentric circles may need to be adjusted to follow the path over which spores may have dispersed [e.g. mail handling areas and walkways, etc.]).

6.3.1.2 Statistically-Based Strategy

The need for statistical sampling will be based on whether the source of contamination has been identified. If contamination is likely to be present in a building or area (e.g., based on suspicion, investigation, epidemiology, etc.) and the source has not been identified, the approach will rely heavily, if not solely, on statistically-based sampling. The objective of statistical sampling is to maximize the probability of detecting contamination. It should also offer a level of confidence that a negative result means that there is no contamination present. Since there are no conclusive published studies that offer appropriate confidence levels considering sampling and laboratory inefficiencies[2], consultation with experienced sampling experts should be considered.

6.3.1.3 Air Movement and HVAC Considerations

Spore-bearing particles less than 10 microns in size, or spores themselves, may remain suspended in the air for long periods of time (i.e., hours or days). In such cases, spores may spread throughout an air space and into adjacent areas on localized air currents, such as those created by people walking by, and also through generalized airflow created by HVAC systems. To fully assess the extent of contamination, the investigator should extend beyond the concentric

[2] For additional information regarding statistical methods, the American Industrial Hygiene Association has published a document titled, "A Strategy for Assessing and Managing Occupational Exposures." Topics covered include establishing the strategy, uncertainty analysis, descriptive statistics, probability plotting, tolerance limits, and exceedance tests and estimating means and confidence intervals. The document is available for purchase at http://www.aiha.org/PublicationsAdvertising/html/pressonline.htm.

circle approach to sample areas on projected contaminant pathways, such as those associated with air movement, dust collection, or work process flow. The HVAC system should be sampled first to determine if it is contaminated. The HVAC filter system is a likely place to initiate the sampling followed by the duct work of the HVAC system. To evaluate the rest of the building, the investigator may apply a statistical approach similar to that used in indoor environmental quality investigations of bioaerosols.

6.3.1.4 Sampling Quality Assurance and Control (QA/QC) Considerations

The sampling objectives will dictate the rigor of the QA/QC program for a given site or task. However, to insure the legitimacy of sampling results, appropriate QA/QC measures must be incorporated into the sampling approach. QA/QC includes four key elements:

- QC of field activities,
- Sample documentation and management,
- Sample handling and shipment, and
- Data validation and management.

QA/QC measures should consider providing field blank, method blank, equipment blank, and trip blank samples, duplicate samples, and laboratory assurance reviews. All samples must have an unbroken chain of custody from collection through analysis. Any variance to the sampling plan must be documented.

Regardless of the level of effort, detailed notes should be taken to document the methodologies used to create sampling strategies and to collect the samples. Comprehensive records, including photographs when needed, often prove helpful in interpreting analytical results and fully evaluating potential risk.

A well-staffed data management cell is essential for interpreting and distributing information, especially at anthrax-contaminated sites, where hundreds or thousands of samples may be collected. In the absence of an effective data management system, data may quickly become too cumbersome to manage. Depending on the estimated extent of contamination, a data management system could include available electronic databases, geographic information system mapping, web-based technologies, or any combination of these options.

6.3.2 Verification Sampling Prior to Occupancy

Decontamination is covered in Chapter 7, but the effectiveness of decontamination should be confirmed by post-decontamination environmental sampling in ambient air; and in areas and on surfaces that were previously contaminated. Verification sampling prior to occupancy should include surfaces and air in the area outside the exclusion zone to ensure that the area continues to remain free of spores.

6.3.2.1 Post-Decontamination Surface Sampling

Using statistical principles, a percentage of previously contaminated surface areas must be sampled to offer a level of confidence that contamination will be detected if it is still present. As previously mentioned, these confidence levels will not consider sampling and analytical inefficiencies. The percentage of coverage may vary according to the size of the area and the location of the release.

As discussed in Chapter 7, where fumigation is used for decontamination, biological indicators such as spore strips, should be used to verify whether the conditions necessary to destroy anthrax spores have been achieved.

6.3.2.2 Air Sampling

Aggressive air sampling techniques have been developed for recent anthrax responses. These techniques model EPA guidance for clearing facilities for re-occupancy after asbestos decontamination. While the area is under negative pressure, all surfaces are aggressively agitated and air is continuously disturbed while samples are collected. An air sampling method that maximizes the likelihood of detecting contamination should be used.

6.3.3 Sampling Methods

This section provides an overview of different sampling techniques. As stated above, it is important to carefully identify the sampling objectives before determining the best sampling approach. A sampling plan may include collection of bulk, surface, and/or air samples, and it may be necessary to use a combination of sampling methods to adequately characterize a contaminated area. As described in Table 6-1 below and Appendix C, each sampling method has specific advantages in particular applications. It is essential to consult with laboratory personnel to determine the capabilities of their laboratories and the analytical processes that they use. It is also important for the workers taking samples to recognize that their own activities and the sampling methods themselves could disturb the areas being sampled, and, therefore, alter the results.

6.4 Analytical Methods

There are various analytical methods available for determining the presence of anthrax in air and surface samples.

Table 6-1
Comparison of Surface and Airborne Sampling Methods for *Bacillus anthracis*

Sample Type	Description	Advantages of Use	Disadvantages of Use	Best Application
Surface and Bulk Sampling[3]				
Wet Wipe	Wiping small areas (e.g., less than 8 sq ft) with a sterile, non-cotton, moistened pad. Multiple surfaces can be sampled however, pad must stay moistened. The wipe can be moistened with a nutrient solution, buffer solution, or deionized water.	• Can be sensitive to trace amounts • Does not require a large amount of bulk material to be collected • Traditionally accepted sampling method	• Sampled area is small (e.g., 8 ft sq.), therefore a large number of samples must be taken to characterize a large area • Less effective for porous surfaces • Some laboratories are not familiar with handling this media	• Screening of small surfaces such as a desktop • Extent and location of contamination • Effectiveness of decontamination in a specific location • Screening of specific items
Wet Swab	Swabbing a small area with a series of "S" like patterns with a moistened, non-cotton sterile swab. The wipe can be moistened with a nutrient solution, buffer solution, or deionized water.	• More laboratories (level A and B) familiar with handling this media • Small sample for hard to reach areas • Traditionally accepted sampling method • Most efficient for areas less than 4 in sq.	• Sampled area is very small • Large number of samples must be taken to characterize a large area • Less effective for porous surfaces	• Screening of very small areas, hard to reach areas (e.g., fan blade) or items • Extent and location of contamination of very small surfaces (e.g., exhaust fan blade) • Screening of specific items
High-Volume Vacuum with "HEPA" Sock (Alsock)	Samples are collected in a HEPA sock that has been designed to fit into an inlet nozzle of a vacuum cleaner.	• Allows for samples of large surface areas • Used on porous and non-porous surfaces • Empirical results from this method have found positives while previous methods have been negative • Has ability to be used in different applications • High capture velocity may help capture dust in hard to reach areas	• Need significant amounts of dust • More difficult logistically • Potential to aerosolize spores • Relatively delicate, sock can rip with rough handling	• Screening of large area • Extent and location of contamination of large areas • Post-decontamination sampling • Transitional sampling

[3] For additional information and procedures on surface and bulk sampling see OSHA 0553 (available at www.osha.gov) and CDC's "Procedures for Collecting Surface Environmental Samples for Culturing *Bacillus anthracis*" (available at http://www.cdc.gov/niosh/nmam/pdfs/chapter-j.pdf).

Table 6-1 (continued)
Comparison of Surface and Airborne Sampling Methods for *Bacillus anthracis*

Sample Type	Description	Advantages of Use	Disadvantages of Use	Best Application
Bulk Sampling	Removing a bulk sample from a suspected delivery device (i.e., package or letter) or a vacuum or HVAC filter or bag. Collection of samples includes use of spoon.	• Effective for evaluating target threats and articles considered suspicious • Used to assess potential exposure into HVAC system	• Laboratory may have difficulty analyzing bulk materials • Specificity limited to size of area sampled	• To initially determine whether anthrax is present in a delivery device • Supplement to Preliminary Assessment
Air Sampling[4]				
Gelatin Filter (low volume)	Gelatin filters are specifically designed for the detection and analysis of airborne microbes. Typically run for 45 minutes at 2 liters/min (or until gelatin dries out).	• Proven to be very sensitive for the air-volume sampled since there is no extraction • No sample extraction needed • Sample personal breathing zones • Can be designed to be used as surface sampling device (micro-vac) • Can be used for PCR or laboratory culture	• Short sample time (45 minutes) • Only a small amount of air (100 liters), would require many samples compared to high-volume sampling devices • A high number of samples are needed for statistical validity • During extended sampling, the gelatin can dry out in low humidity and can distort in high humidity altering the collection characteristics.	• Worker breathing zone samples for industrial hygiene monitoring of specific tasks (e.g. workers conducting aggressive air sampling during post-decontamination sampling)
Mixed Cellulose Ester (MCE) Filter	Open faced 37mm mixed cellulose ester (MCE) filters (0.8 micron pore size) attached to industrial hygiene sampling pumps.	• Larger sample volumes and times compared to gelatin filter • Sample personal breathing zones • Can be designed to be used as surface sampling device	• Questionable sample extraction efficiency • Laboratories not familiar with sample handling	• Not recommended at this time until extraction efficiency can be established. Recommend that an extraction efficiency study be performed since the advantages of MCE filters over gel filters would allow longer sample times

[4] For additional information on the sampling and characterization of bioaerosols see http://www.cdc.gov/niosh/nmam/pdfs/chapter-j.pdf and OSHA guidance available at www.osha.gov.

Table 6-1 (continued)
Comparison of Surface and Airborne Sampling Methods for *Bacillus anthracis*

Sample Type	Description	Advantages of Use	Disadvantages of Use	Best Application
Andersen air Sampler and single stage impactors with seetle plates	Size selective sampler captures airborne particulates on a series of agar plates based on their aerodynamic properties.	• Size selective sampling • No sample extraction needed • Traditionally accepted sampling method • Organisms remain intact and viable	• Very short sample times and volume (300L) • Requires many samples which increases costs and handling logistics	• Post-decontamination sampling for small volume rooms assuming many samples are taken • Size selective sampling to determine whether anthrax spores have been weaponized
Open Agar Plate	Open faced petri dishes containing Sheep's Blood Agar are placed in the area to be sampled.	• No sample extraction needed • Longer sample times • Easy and simple--no specialized equipment necessary • Organisms remain intact and viable	• Relies on spore settling for collection • Not size selective • Not likely to collect respirable spores • Low yield	• Possible in highly contaminated environments
Dry Filter Unit **(High-Volume Air Sampler with Polyester 1-Micron Filter)**	Air samples are collected utilizing a Dry Filter Unit (DFU) developed by the Joint Program Office for Biological Defense (JPO-BD). The unit consists of a high flow air sampling pump that collects airborne anthrax on 47-mm polyester 1-micron filters (PEF-1 filters).	• Large sample volumes reduces number of samples • Eventually may relate to air exposure limits • Most direct indicator of airborne anthrax spores	• Lower extraction efficiency than wet methods • Laboratories not familiar with sample handling • Not size selective • Evaluation of method has not completed	• Post-decontamination sampling as a supplement to surface samples
Liquid impingers	A known volume of air is pumped through the impinger containing a method specific liquid (i.e., mineral oil), which captures particulate bioaerosols. The liquid can then be analyzed.	• Long sampling time (only for mineral oil) • Increased collection efficiency • Preserves viability • Non-evaporating liquids (only for mineral oil) • Can be analyzed via multiple methods	• Small and delicate instrument • Decon requires autoclaving • Liquid media difficult to use	

6.4.1 Immunoassay Tests

Hand-held assays, sometimes referred to as "smart tickets," are sold commercially for the rapid detection of *B. anthracis* and other biological agents. These assays are intended only for screening environmental samples. Due to their inherently low and questionable sensitivity, they cannot be relied on for a determination that anthrax is or is not present. These assays are currently under evaluation by CDC and the FBI.

6.4.2 Polymerase Chain Reaction (PCR)

PCR is a technique that amplifies DNA and compares sequences to known test probe standards for *B. anthracis*. PCR can be used in the field or the laboratory; in either case, the samples must be cultured to confirm that the bacteria is *B. anthracis* and that it is viable. Field PCR systems are very selective, but do not work well with heterogeneous environmental samples, and the probes are very expensive. PCR has been shown to work best as a final confirmation of positive samples taken from plated colonies.

At the present time, until further validation testing is complete and guidelines for effective use are developed, field-based PCR- or immune-based assays for *B. anthracis* should not be used alone, but should be confirmed with samples analyzed by culture methods.

6.4.3 Culturing

Samples may also be analyzed for anthrax using a traditional lab culturing technique. The sample is appropriately prepared for elution and plating, after which it is inoculated onto plates containing sheep blood agar. The plates are allowed to incubate for several hours and are then examined for growth of suspicious colonies. Most sampling methods include detailed analytical procedures for culturing anthrax samples.

6.4.4 Laboratory Coordination

As discussed above, the laboratory selected for the sample analyses should be consulted by the team developing the sampling plan. The lab should be authorized for work with *B. anthracis* and laboratory procedures must conform to guidance provided by CDC or the Association of Public Health Laboratories (APHL). To help public health laboratories across the nation prepare for and respond to acts of terrorism, including bioterrorism, CDC, APHL, and the FBI have developed the Laboratory Response Network (LRN). The LRN was also designed to strengthen relationships between the medical care community and public health systems.

Membership in the LRN is primarily county, city, state, and federal public health laboratories. This network of laboratories can accept specimens and samples from hospitals, clinics, the FBI and other law enforcement groups, emergency medical services, the military, and other agencies. The public health laboratories in the cities and states were designated to shoulder the bulk of the

testing for etiologic agents. Use of any other labs would risk the health and safety of the occupational work force, the stability of the national public health system, and the security of the nation. Based on the equipment it has available, the selected lab may have limitations on the number and types of samples it can handle. These limitations should be identified before sampling begins.

6.5 Packaging and Transportation of Samples

There are strict requirements for packaging and transporting anthrax samples to ensure that the general public and workers transporting the samples are protected from exposure. These requirements include:

- Rigorous packaging designed to withstand rough handling and prevent leakage,
- Appropriate marking and labeling that identifies the contents of the package,
- Documentation of the hazardous contents of the package and emergency point-of-contact, and
- Training of transportation workers on how to handle the contents in the event of an emergency.

Packaging and transporting anthrax samples are subject to various regulations established by DOT, CDC, USPS, OSHA, and the International Air Transport Association (IATA). It is also important to consult with the analytical laboratory receiving the samples to determine whether they have additional packaging or shipping requirements. Additional details on packaging and shipping procedures for anthrax samples, according to CDC guidelines, can be found at www.cdc.gov/od/ohs/biosfty/shipregs.htm or www.bt.cdc.gov/LabIssues/PackagingInfo.pdf.

6.6 Interpretation of Results

A multi-disciplinary team of technical experts should interpret analytical results. Consultation with field investigators and laboratory personnel during the interpretation process will provide the best insight into sample collection and recovery. Since analytical methods are not fully validated for *B. anthracis*, investigators who review and interpret the results of environmental sampling should consider these limitations and use professional judgment in interpreting any positive or negative findings as well as quantitative or semi-quantitative results.

In the case of preliminary assessment sampling, positive findings will usually require more extensive sampling in that particular area. Laboratories will sometimes report "colony counts" with positive results. In some cases, colony counts can help the data interpretation teams decide how much more extensively to sample in that area, prior to establishing additional isolation and starting decontamination. However, quantitative methods have not been validated for a variety of sample collection methods and the use of "colony count" data is not yet accepted as a reliable indicator of large populations of colony forming units.

Typically, if the results of post-decontamination sampling, including biological indicators such as surrogate spore test strips, show evidence of remaining viable spores, additional decontamination will be necessary. However, negative verification sample results may not necessarily confirm that there is no need for further action. The multi-disciplinary team described above should establish a decision tree for evaluating the adequacy of the sampling and decontamination to coordinate its efforts in reaching a unified conclusion.

6.7 Coordination with Affected Parties

Before, during, and after a response, the sampling team should coordinate with the facility manager, union officials, and other individuals who might have site-specific knowledge of the contamination.

The sampling plan should indicate how employees working within the affected sampling area will be informed of the sampling objectives and methods and when and how results will be provided to them. Before sampling begins, employees should be told when, where, and why sampling may occur and they should also be advised when plans are changed.

CHAPTER 7. DECONTAMINATION

This section provides information on decontaminating buildings or specific areas, systems, or items within buildings after an actual release of anthrax. Decisions regarding decontamination strategies should be made on a case-by-case basis by the ICS/UC, considering the specifics of the anthrax release. The selected decontamination strategy should involve consultation with environmental and health officials from the federal, state, and local governments as well as with technical experts (such as HVAC contractors); the manufacturers of building furnishings, equipment, and other contents; building architects, owners, and residents; and others as needed.

Anthrax decontamination is an iterative process that may involve the use of multiple decontamination processes and technologies. Selection of appropriate technologies varies depending on factors specific to the release and to the technologies themselves, but the primary considerations are always the effectiveness and safety of the products and processes. Each technology varies in terms of effectiveness on different surfaces (e.g., porous vs. non-porous) and under different environmental conditions. The relative toxicity of decontamination by-products, both during and after application, is variable. Certain decontamination processes and products may damage sensitive items, such as computers, photographs, or art.

Decontamination may occur both on-site or off-site, but consideration should be given to the cost of transporting contaminated materials off-site and the potential for spreading contamination. For areas or items that will be re-used, effective decontamination should be confirmed by appropriate sampling after decontamination is completed. If the cultured samples show signs of bacterial growth, further decontamination will be necessary, until confirmatory samples show no growth of *B. anthracis* spores from all environmental samples. In some cases, it may be more expensive to decontaminate an item for re-use than to treat it for disposal and replace it.

The decontamination process will generate potentially contaminated waste materials, including personal protective equipment, wastewater, and unwanted debris such as carpets, draperies, ceiling tiles, and papers. These wastes must be safely disposed of as discussed in Chapter 8.

This chapter provides an overview on:

- Planning and preparing for decontamination;
- Various decontamination technologies, including their benefits and considerations for use;
- Off-site decontamination; and
- Criteria for confirming decontamination effectiveness.

Products discussed in this chapter have been reviewed by EPA's Office of Pesticide Programs (OPP) and granted a crisis exemption for their use under specific conditions. The regulatory status of individual technologies must be considered in developing a decontamination strategy. Antimicrobial products are either pesticides or pesticide devices that must be used in compliance with the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). Under FIFRA, EPA

regulates the sale, distribution, and use of pesticides in the U.S. through registration or exemption of individual pesticide products. No pesticide product may be sold or distributed in the U.S. unless EPA has reviewed data for that product, determined that use of the product will not present unreasonable risk to humans or the environment, and issued a registration or exemption under FIFRA. Section 18 of FIFRA authorizes EPA to allow states or federal agencies to use a pesticide for an unregistered use for a limited time if EPA determines that emergency conditions exist.

EPA's Technology Innovation Office (TIO) has developed an information clearinghouse (www.EPATechBiT.org) as a centralized location to collect and disseminate information about decontamination technologies and also for technology vendors to provide information. For regulatory purposes, technologies are divided into antimicrobial pesticide products that claim effectiveness against microorganisms and therefore must be registered with OPP and pesticide devices that work through other means. Those devices simply require a pesticide establishment number. Antimicrobial pesticides are being evaluated by OPP and pesticide devices are being evaluated by an inter-agency expert peer review panel. For more information including evaluation status of technologies not discussed in this chapter, refer to the TIO web site.

7.1 Planning for Decontamination

Cleaning an area or item contaminated by anthrax involves numerous and variable issues that are specific to individual locations. No single technology, process, or strategy will be effective in every case. Responders must develop a decontamination plan that takes into account:

- The nature of the contamination – including type of anthrax involved, how it entered the facility, and the physical characteristics that affect the spread of contamination;
- The extent of contamination – including amount of contamination and possible pathways by which it could have or will spread; and
- The objectives of decontamination – including intended re-use of facility and building systems and whether items will be decontaminated for re-use or treated for disposal.

The extent of contamination and how the contamination spread are critical considerations in isolating affected areas and selecting appropriate decontamination technologies. For example, if spores are widely dispersed and have traveled through the air, decontamination may involve extensive isolation and fumigation. In contrast, if the contamination is limited to a small area and spores are not likely to become airborne, then minimal isolation and surface decontamination methods alone may suffice.

The need to decontaminate building systems (e.g., HVAC systems), personal effects, and sensitive items (e.g., computers, photographs, or irreplaceable art) should also be considered in developing a decontamination plan. Techniques used on building surfaces or items may not be

effective for decontaminating ventilation systems, and if spores have dispersed into the air, decontamination of the ventilation system may be vital to the effectiveness of the overall effort. Some technologies may damage certain surfaces or items, whereas other technologies appear to cause little or no damage. Decontamination plans for personal effects and items should be developed in consultation with their owners. Consideration should be given to the presence of potentially hazardous materials in personal effects or other workplace materials.

In areas where there is high potential for spread of contamination (e.g., ventilation systems or high-traffic hallways and mail routes), it may be appropriate to decontaminate those areas even though sampling may show no positive evidence of contamination. Finally, the decontamination plan should include a carefully developed strategy for confirming that chemical residuals from the decontamination agents are adequately removed or reduced to an acceptable level.

All stakeholders – local authorities, building owners and residents, federal, state, and local environmental and health agencies, the affected public, and others – should be consulted before decontamination begins. A site safety plan is needed to protect workers inside and outside the contaminated area, as well as the surrounding population. The facility manager should notify employees and others (e.g., union representatives) of the nature and scope of the work and its expected duration.

7.2 Preparing for Decontamination

The results of the sampling for extent of contamination (discussed in Chapter 6) should make it possible to distinguish between contaminated and uncontaminated areas and to determine the types of surfaces involved. To prevent the spread of contamination by movement of workers or equipment, it may be advisable to isolate the contaminated area. This will depend on factors such as the size of the affected area, the types of surfaces, and the extent of contamination. The decision to establish an isolation area should be made in consultation with public health experts. If the area of contamination is small, discrete, and confined to limited surfaces, it may suffice to simply cordon off the area. Larger areas can be closed off using polypropylene sheeting, tape, and other products, similar to methods used for asbestos abatement. If needed, a higher level of isolation can be achieved by creating negative air pressure to prevent the outward flow of air. A negative pressure environment can be produced by using portable HEPA-filtered negative air units in the affected areas.

The HVAC ducts serving the affected area may also need to be sealed. Plastic sheeting, tape, or other products may be used to minimize the movement of air and contamination in or out of these ducts. The ducts may be sealed within the affected room or at external locations as long as the selected decontamination technology (e.g., fumigation) will effectively decontaminate the ductwork between the room and the external seal. An HVAC specialist should be consulted.

Decontamination should address:

- Hidden sources of contamination – Desktop computers and other objects with internal fans that draw air into the case may have filters or electrostatic devices to control dust intake. These filters or the equipment chassis may be a reservoir of contamination. If selected technologies may damage the item or may not penetrate to hidden locations, then these items may be dealt with in an alternative manner. The manufacturer of the device should be consulted if it is to be saved for re-use.

- Pre-cleaning – Excessive amounts of dirt or other organic material on the surface to be cleaned may decrease the effectiveness of the selected decontamination method. Using certain techniques, such as HEPA vacuuming, to remove some of the dirt and debris could reduce the need to perform more aggressive chemical decontamination.

- Removal of items – To reduce potential spread of contamination, items should be decontaminated in place. If the selected technology will destroy an item that must be salvaged, then the item may be removed and decontaminated elsewhere with an alternative technology. This requires a means of safe transport and a separate isolation chamber, which adds complexity to the decontamination process.

7.3 Decontamination Technologies

Decontamination technologies can be divided into three categories:

- Surface decontamination products, which are used to treat spores on hard, non-porous surfaces such as desks, walls, and hard flooring.

- Fumigation, which involves use of an antimicrobial gas or vapor to destroy aerosolized spores and spores adhered to non-porous and porous surfaces.

- Other decontamination products, which are primarily used in chambers or other specialized equipment.

As discussed above, selection of the appropriate technology will require an evaluation of the specific site conditions and nature of contamination. Other considerations include the conditions required for effective application (e.g., humidity for fumigations or pH for certain surface treatments), how the technology will affect the area or item being treated, and the risks associated with use (e.g., physical, chemical, and toxicologic parameters of the product). The sections below provide a general description of the different technologies and some of these considerations.

7.4 Methods Used on Surfaces

Methods used to treat surfaces include vacuuming, which can be used on both porous and non-porous surfaces for the physical removal of spores, and liquid antimicrobial products (e.g., aqueous chlorine dioxide, sodium hypochlorite, and a combination of hydrogen peroxide and peroxyacetic acid), which are primarily used for non-porous surfaces to eliminate and/or reduce the number of spores.

7.4.1 High Efficiency Particulate Air (HEPA) Vacuuming

Vacuuming surfaces with a vacuum cleaner equipped with a HEPA filter accomplishes two purposes: (1) it helps remove dirt and other debris that may reduce the effectiveness of subsequent decontamination, and (2) it also removes some of the spores, reducing the number to be killed by subsequent decontamination. A variety of vacuum assemblies are needed for the many surfaces and shapes to be treated. The HEPA vacuum is systematically applied to collect spores from the area of lowest contamination to the area of highest contamination, and from highest to lowest elevation. The collected dust and material may be sampled to determine the presence of spores. After vacuuming, the area may be cleaned using another method and sampled to verify decontamination or determine the extent of remaining contamination.

An advantage of this technology is that there is little potential for damage to furnishings. A limitation of this technology is that it can only remove surface contamination (e.g., spores in the interior of a computer may not be removed effectively). The operator must also avoid allowing the exhaust to stir the air in the affected room. Contaminated filters should be safely disposed of, as described in Chapter 8.

7.4.2 Liquid Antimicrobial Products – Not for Porous Surfaces

Liquid antimicrobial products may be used to inactivate spores on hard surfaces only. These products, which can be applied by pouring, mopping, or spraying, include oxidizing, bleaching, or other agents, such as aqueous chlorine dioxide, sodium hypochlorite, hydrogen peroxide, and peroxyacetic acid combined.

Several factors should be considered when deciding which liquid antimicrobial products to use and how to apply them. Each product affects surfaces differently in terms of corrosivity, staining, and residue. These products will be effective only if the directions for use of the product are followed precisely (e.g., mixing directions, application method and dosage rate, pre-cleaning of surfaces, and contact time).

7.5 Fumigation

Fumigation is defined in this document as the application of a gas or vapor to reduce or eliminate spores in an indoor area (e.g., a room or building). In addition to decontaminating a variety of

surfaces, fumigants are able to decontaminate airborne spores that a surface cleaner would miss. Examples of fumigants are chlorine dioxide and paraformaldehyde, which are described in more detail in Appendix C. Methyl bromide also has the potential to be an effective decontaminant, and EPA has recently granted an exemption for limited testing of its effectiveness. If results of this testing are positive, it will be included in future revisions of Appendix C.

Selecting a specific fumigant requires an assessment of the chemical and physical properties of the various chemicals, their toxicologic properties, and their compatibility with other materials. For example, fumigants vary in stability (i.e., some have a short half-life or decompose under certain conditions), corrosivity, human toxicity (some are known carcinogens), explosivity, and other characteristics. They also vary in their ability to dissipate and their ability to penetrate various surfaces.

Determining whether to use fumigation and which fumigant to use also requires an understanding of the preparation and application requirements. The success of any fumigation will depend on:

- The use of qualified professionals,
- Containing the fumigant by thoroughly sealing the area to be decontaminated,
- Understanding how liquid spills or organic material may absorb the fumigant,
- Setting up appropriate means to distribute the fumigant evenly,
- Achieving the required temperature, humidity, and other conditions prior to application of fumigation,
- Monitoring the fumigant concentration to assure that the required concentration is maintained for the required amount of time (taking into account potential loss of fumigant to organic items, such as carpet),
- Monitoring outside the area for leaks during the fumigant application and during subsequent aeration,
- Following all directions and precautions specified on the product label (if one exists) and in the site-specific decontamination plan, and
- Allowing sufficient time following fumigation for aeration (i.e., off-gassing) of fumigant and by-products formed during the treatment process.

7.6 Other Decontamination Products

Technologies that can be used to decontaminate specific items outside the affected area or environment include chemical sterilization and irradiation. Factors that have been used to evaluate these options include the cost and risk of transporting contaminated materials, the potential for spread of contamination, the availability of mobile equipment to bring the technology to the site, and the availability of facilities capable and willing to perform the task.

7.6.1 Chemical Sterilization

In chemical sterilization, chemicals such as ethylene oxide, chlorine dioxide, or paraformaldehyde are used to kill spores on discrete items placed in a sterilization chamber. Sufficient aeration of the items following treatment is necessary to remove residual amounts of the sterilant and any toxic by-products that may have formed. For effective decontamination, each chemical sterilant has specified ranges of temperature, relative humidity, concentration, and duration of application.

7.6.2 Irradiation

Numerous irradiation techniques, including cobalt-60 and electron beam technologies, can effectively destroy anthrax. These techniques are generally only available for off-site decontamination. They may destroy magnetic media, such as film or videotape, and they tend to be expensive.

7.7 Judging the Effectiveness of Decontamination

There are separate criteria, described below, for judging the effectiveness of decontamination of objects in an off-site sterilization chamber, and for decontamination of sites, such as offices or buildings.

For objects decontaminated in an off-site sterilization chamber, biological indicators, such as surrogate spore test strips, should be placed in the chamber along with the objects. For decontamination to be judged effective, biological indicators cultured in a nationally accredited lab should show no evidence of bacterial growth. If any of the indicators show growth of the bacterial species, then the sterilization process should be repeated until none of the indicators show any bacterial growth.

To determine whether decontamination of a site has been effective, a rigorous round of environmental sampling should be performed following the decontamination process, and the samples should be cultured for *B. anthracis* in a nationally accredited lab. Post-decontamination sampling strategies, which should be developed by an on-site industrial hygienist, are discussed in more detail in Chapter 6.

Rigorous environmental sampling should be done in all decontaminated sites, regardless of type of technology used or the extent of the decontamination. In areas that have been fumigated, biological indicators (such as surrogate spore strips) should be used as well, to determine whether the fumigant has effectively permeated the area under specific conditions (i.e., concentration, time, temperature, and relative humidity) sufficient to kill *B. anthracis* spores. The results of the culture of both the environmental samples and the biological indicators should be evaluated to determine the effectiveness of the fumigation.

If the cultures of any environmental samples show confirmed growth of *B. anthracis*, it is clear that the decontamination has not eliminated all viable spores. On Capitol Hill and at the Morgan postal facility in Manhattan, decontamination was considered to be complete only when there was no bacterial growth on post-decontamination samples. In the absence of a scientifically sound basis for an alternative decontamination goal, "no growth" is the best possible way to ensure safety in re-occupying a decontaminated area. Moreover, all crisis exemptions (see Chapter 7) issued to date by EPA for the use of pesticide products to decontaminate anthrax spores have included a requirement to continue decontamination until all post-treatment environmental samples show no evidence of bacterial growth.

A different technology may be used for further decontaminating an area in which sampling showed the presence of viable anthrax spores. For example, if evidence of bacterial growth is found only on a desk in an office that was fumigated, an approved liquid sporicidal product may be applied to complete decontamination of the desk.

Once an area has been determined to be effectively decontaminated, there is no guarantee that all viable spores have been eliminated, even when post-decontamination samples show no growth. Moreover, statistical calculations of the effectiveness of sampling and analytical methods indicate that some spores may remain in a decontaminated area even though environmental sampling shows "no growth." Nevertheless, the potential risk of a person contracting the disease in such an area is considered to be extremely low.

As the agency responsible for ensuring safety in the workplace, OSHA believes that there may be safe alternatives to the "no growth" decontamination goal, especially in workplace situations where the use of PPE, special work practices, or other engineering controls might also minimize the risk of disease. OSHA is evaluating alternative options that might allow a decontamination goal that stops short of "no growth," if use of other workplace protections can safely allow workers to occupy an area that may contain residual spores.

This approach is consistent with the NCP, which allows case-by-case decisions based on the future use of the site and other controls that might be used to ensure safety. Decisions on alternative options such as these would have to be site-specific, and supported by experts in epidemiology, public health, industrial hygiene, and environmental protection. The basis for these types of decisions should also be thoroughly documented. At least for now, any

contaminated area that will ultimately be occupied by workers or visitors not wearing PPE, should be decontaminated until post-decontamination samples show no bacterial growth.

Much more work needs to be done in this area, and the NRT intends to deal with this issue in greater detail in the next iteration of this document.

CHAPTER 8. COLLECTION, TREATMENT, AND DISPOSAL OF WASTES

This chapter discusses the management of wastes from anthrax-contaminated sites. Articles that will be treated and kept for re-use are discussed in Chapter 7. This chapter:

- Emphasizes the importance of consulting with state and local waste management authorities,
- Identifies the possible types of contaminated wastes, including wastewater,
- Explains the need to notify waste and recycling service providers of potential contamination, and
- Describes how to manage wastes that are or may be contaminated.

Waste management considerations, including treatment and ultimate disposal, should be factored into decisions related to the development of an overall decontamination strategy. Anthrax-contaminated wastes are not regulated under Subtitle C of the Resource Conservation and Recovery Act (RCRA), but they should be handled with caution due to the potential for exposure to an infectious agent. In some states and localities, these wastes are considered medical waste or infectious substances with special requirements for handling and disposal. Therefore, it is important to contact the state or local regulatory agency early on to determine what state or local requirements apply and what treatment and disposal options are available. State authorities have the primary responsibility to regulate and oversee management of wastes that may be contaminated with an infectious agent such as anthrax.

In addition, such waste may be subject to DOT and other pertinent agency requirements applicable to the transportation of infectious substances. DOT and other pertinent agencies should be consulted if there are any questions about transporting wastes that are contaminated with infectious agents.

In this chapter, the term "treatment" means subjecting a waste to a process that will reduce or destroy anthrax spores prior to disposal off-site. In most cases, anthrax-contaminated wastes should be treated on-site to reduce or destroy spores, tested to confirm treatment effectiveness, and treated further, if necessary, until post-treatment sampling shows no indication of remaining viable spores. If this process is followed, the treated wastes can then be disposed of as municipal solid waste or waste water, given approval from appropriate state and local authorities.

When total elimination of spores cannot be confirmed, the wastes must be properly packaged and transported to a state or locally approved waste treatment facility capable of destroying any remaining spores. Depending on the capacity of available off-site facilities and the size and volume of wastes to be treated, either medical or other equivalent types of waste treatment facilities may be used. State or local approval, including approval of any necessary facility-specific handling protocols, should be obtained for all off-site treatment.

8.1 Waste Types

The most common types of wastes resulting from assessment and decontamination of anthrax contamination include:

- **PPE** and other materials used in assessment and decontamination;

- **Debris** intended for disposal, which could include:
  - Small materials removed from the building (e.g., books, papers, pictures and wall hangings, etc.);
  - Small equipment and office items (e.g., staplers, telephones, hand tools, etc.);
  - Large durable materials removed from the building (e.g., furniture, computers, copiers, fax machines, printers);
  - Building and decorating materials such as carpeting, draperies, window blinds, window air conditioners, ceiling panels, wallboard, and paneling;
  - Mail suspected of contamination, identified and processed in accordance with Postal Service regulations; and
  - Trash, food, and other unwanted materials present at the site at the time of contamination. *(Note: Items that will be kept and re-used are discussed in Chapter 7.)*

- **Wastewaters** generated during decontamination, including chemicals used to treat PPE, subsequent rinses, and air scrubber waters associated with fumigation.

8.2 Notification of Waste and Recycling Service Providers

If there is reason to believe that a building or site may be contaminated with anthrax, authorized facility personnel should immediately notify their waste hauler and recyclables collector. The facility personnel should provide the suspected date on which contamination may have occurred, and update the waste and recyclables collector as further information becomes available. If anthrax is confirmed, pickups of solid waste or recyclables from potentially contaminated areas may need to be discontinued.

The public should also be notified about the nature of any contamination that has occurred and the process that will be used to manage, treat, and dispose of the waste (see Chapter 9).

8.3 Waste Management

This section outlines practices for on-site treatment or packaging, storage, transport, off-site treatment, and final disposal of wastes from anthrax-contaminated sites. If "extent of contamination" sampling confirms the absence of anthrax in specific confined locations, waste generated exclusively from those "anthrax-free" areas may be managed as municipal solid waste. In order to avoid unnecessary extra handling, waste from these areas must be physically segregated from waste removed from potentially or known contaminated areas of the facility.

If anthrax contamination is present or suspected, the practices described below are options for minimizing the risks of handling and disposing of the wastes.

8.3.1 On-Site Treatment

In general, wastes will be treated before being moved to a storage location or off-site for further treatment or disposal. Options for treating wastes on-site include the use of HEPA vacuuming, antimicrobial solutions, and fumigation (see Chapter 7). It may be necessary to use more than one of these options to effectively deal with certain types of contamination.

If treatment effectively eliminates all viable spores, the waste may then be disposed of as municipal solid waste, as long as appropriate state or local officials allow it. To confirm the effectiveness of treatment, wastes should be sampled after treatment. These samples should be cultured and analyzed for spore growth. If there is no indication of spore growth in any of the samples, then treatment is considered to be effective.

In cases where: treatment effectiveness cannot be confirmed; there are practical limits on the amount of post-treatment sampling that can be done; or on-site treatment is not practical or desirable, then additional precautionary treatment may be needed to minimize contamination prior to disposal. Special transportation requirements also apply.

Wastewaters generated in the anthrax decontamination process should be pre-treated prior to off-site treatment and/or disposal. Pre-treatment can be accomplished by adding a registered sodium hypochlorite solution of 5.25% - 6% (bleach) to the wastewater. A bleach/wastewater solution of 5000 to 6000 ppm with a neutral pH (at or just below pH 7) can be achieved by mixing one part bleach to one part white vinegar to eight parts wastewater and allowing the solution to sit for one hour.

Representative samples for pH and anthrax analysis should be collected from the pre-treated wastewater. Once laboratory analysis verifies the absence of viable spores in the pre-treated wastewater samples, the pre-treated wastewater can be transported or discharged for disposal at a wastewater treatment facility. Approval should be obtained from the appropriate wastewater treatment authority prior to discharge. Consultation with state and local public health authorities is also recommended. The pre-treated wastewater should also be tested for other pre-treatment parameters (e.g., total chlorides, TSS, etc.) if requested by the treatment facility operator.

8.3.2 Storage

Anthrax-contaminated waste may be stored for further treatment or pending test results, in sealed containers that are appropriately labeled. If waste is temporarily stored before transport to off-site disposal, it must be in containers that meet the DOT Division 6.2 (Infectious Substances) packaging requirements described below. The storage area must provide weather protection and prevent access by unauthorized individuals or by vermin.

8.3.3 Transportation

Anthrax is one of the biological agents covered under the Select Agent Rule (42 CFR 72.6). The CDC administers the Select Agent Program. Before transporting anthrax-contaminated waste to an off-site treatment facility, generators should contact the Select Agent Program within CDC's Office of Health and Safety (Ph: 404-639-4418) for any special handling and transportation requirements that may apply. General information on the Select Agent Rule can be found at: www.cdc.gov/od/ohs/Irsat.htm.

Commercial transportation of anthrax-contaminated waste must also meet requirements in the Department of Transportation's Hazardous Materials Regulations (HMR 49 CFR Parts 171-180). These requirements do not apply to waste that has been treated so that the anthrax spores are destroyed. If complete destruction of spores cannot be demonstrated, then the waste should be handled as described below. Anthrax-contaminated waste may **not** be transported as a regulated medical waste.

- Packaging (§§ 173.196, 178.609): Use a triple packaging that is capable of meeting the performance requirements in §178.609 (e.g., drop test, water immersion test) and consists of the following components:

  - Watertight primary receptacle;
  - Watertight secondary receptacle;
  - Sufficient absorbent material between the primary and secondary receptacles to absorb entire contents, if material is liquid;
  - Outer packaging of adequate strength for capacity, mass, and intended use; and
  - Itemized list of package contents placed between the secondary receptacle and the outer packaging.

- Labeling (§172.400): Label the package with an "INFECTIOUS SUBSTANCE" label.

- Marking (§172.301): Mark the package with the words "Infectious substance, affecting humans, UN 2814, (*Bacillus anthracis*), 6.2" and with the name and address of the consignor or consignee. The labeling requirements also permit a generic name (e.g., *Bacillus species*) to be used in place of the technical name (e.g., *Bacillus anthracis*).

- Shipping documents (§§ 172.202, 172.203, 172.204, 172.604): Prepare a shipping paper that includes the following information: "Infectious substance, affecting humans (*Bacillus anthracis*), 6.2, UN 2814," and the quantity being shipped. Include the following certification: "This is to certify that the above-named materials are properly classified, described, packaged, marked and labeled, and are in proper condition for transportation according to the applicable regulations of the Department of Transportation." Also, include an emergency telephone number that is staffed by a person familiar with the material being shipped and with emergency measures to be taken in the event of a leak or other emergency.

If the anthrax-contaminated waste cannot be placed in a packaging that meets the HMR requirements because of its size or form, then an exemption from the HMR is needed to transport the material. The exemption application should specify the type of packaging proposed for use to ship the object. The packaging must be adequate to ensure that spores cannot escape during transportation. Waste haulers must be appropriately licensed or certified by the state, where such programs exist. For details on DOT requirements go to: www.hazmat.dot.gov/guide_anthrax.htm or call the Hazardous Materials Information Center at 202-366-4488 (option 1). Appropriate state transportation regulations should also be examined.

8.3.4 Off-Site Treatment

Depending on uncertainties related to the effectiveness of on-site treatment, the capacity of available off-site facilities, and the size and volume of wastes to be treated, several alternative off-site methods are available to complete the destruction of any remaining spores. Suitable alternatives include:

- Medical waste incinerators,
- Medical waste autoclaves,
- State-approved alternate medical waste treatment technologies,
- Municipal solid waste incinerators,
- Hazardous waste combustion devices, and
- Chemical agent demilitarization incinerators.

Arrangements should be worked out with the state and local regulatory agencies and the owner/operator of the facility to establish a site-specific protocol to ensure that the material is safely received, unloaded, and placed into the device. Waste should not be shredded or broken; they must be packaged in a manner that minimizes handling and they must be separated from other wastes. Treatment units should be assessed for appropriate operational parameters (e.g., proper temperatures, retention times, air flows, pressure, and feed and seal systems that prevent spore emissions). The facility's compliance history should also be examined as an indicator of its ability to maintain operational conditions.

It may be necessary to develop an alternative strategy for storing, packaging, transporting, and disposing of wastes that cannot be treated on-site and that physically cannot be handled in available medical waste facilities. This strategy should be developed jointly by the IC/UC, EPA, DOT, and the affected states and localities.

8.3.5 Disposal

If appropriate state and local officials approve, ash or other residues from anthrax treatment via combustion, autoclaves, or other state-approved treatment technologies may be disposed of as municipal solid waste.

8.4 Conclusion

Anthrax-contaminated wastes can be safely managed in a way that protects both those who handle it and the surrounding community. Cross-functional coordination with stakeholders at all levels of government is essential. It is also important to provide timely, useful, and accurate information to the public about the nature of the contamination and the strategy for treating and disposing of the waste (see Chapter 9). It is especially important that:

- State and local regulatory agencies be contacted early in the process for assistance in establishing and approving a waste disposal strategy;
- Best management practices are used on-site;
- Potentially contaminated wastes are appropriately packaged, labeled, and transported; and
- State-approved alternative off-site treatment devices, such as municipal solid waste incinerators and hazardous waste combustion devices, are operated at conditions equivalent to or exceeding those for medical wastes; check with your state agency to determine what those conditions are.

CHAPTER 9. COMMUNICATIONS, COMMUNITY INVOLVEMENT, AND OUTREACH

The initial focus of emergency response to anthrax contamination is to eliminate immediate or potential threats. Equally important is providing the news media, public officials and the impacted community with updated information on potential hazards, evacuation plans, health concerns, and the status of the response. Terrorism poses special concern because it creates fear and anxiety throughout a community. Establishment of a Joint Information Center (JIC) creates an effective, single point of contact who can provide quick and accurate public information and can work closely with elected officials, community leaders, the health care community, social and support groups, advocacy groups, the news media, and other stakeholders.

This chapter provides suggestions and tools for consideration by people involved in communications and outreach during an anthrax response. These include:

- Establishing a Joint Information Center (JIC),
- Checklists for communications,
- Suggestions for communicating risk,
- Community involvement tools and activities, and
- Assistance from Special Teams

9.1 Establishing a Joint Information Center (JIC)

As described in Chapter 4, the ICS provides a framework for managing the response to an emergency or non-emergency situation. When more than one entity has response authority, the response is coordinated through a UC. Under a UC, all communications to the public are presented in a single, unified voice.

For multi-agency or complicated responses (which an anthrax response is likely to be), the IC should establish a JIC. A JIC is a co-located group of representatives from agencies and organizations involved in an event that is designated to handle public information needs. The JIC structure is designed to work equally well for large or small situations and can expand or contract to meet the needs of the incident. Under the ICS/UC, the JIC is led by the Information Officer, who has the following responsibilities:

- Gather incident data. This involves understanding how an ICS/UC operates and developing an effective method for obtaining up-to-date information from appropriate ICS/UC Sections. It also involves capturing images of the emergency in video and photos that can be used by the response organization as well as the media. A digital camera may be particularly helpful because the images can be immediately available for use in public information messages via the Internet. Use of satellite and two-radio communications capacity should also be considered, since cell phone and land-line service circuits can become quickly overloaded in a crisis.

- Analyze the demographic data – this involves analyzing the impacted community to identify diverse groups (e.g., non-English speakers, cultural differences, population age) which may require additional planning to ensure the information from the JIC is received and understood. Use of GIS software and demographic data bases may be particularly helpful for this analysis. Community and organization leaders are also another potential source of demographic and community data.

- Analyze public perceptions of the response – this involves employing techniques for obtaining community feedback to provide response agencies with insight into community information needs, their expectations for the role to be played by the response agencies, and the lessons to be learned from specific response efforts. It also involves controlling rumors and keeping the IC and Command Staff informed of public affairs issues that could impact the response. Correct any misinformation immediately. Not responding promptly to misinformation by the press leaves the impression that the reports are true.

- Inform the public – that is, to serve as a source of accurate and comprehensive information about the incident and the response to a specific set of audiences. This involves gaining and maintaining public trust and confidence by involving community leaders and media to ensure timely and coordinated release of information. Do not withhold information from the public. It is very likely that the withheld information will be found out, which will cripple your credibility with the press and the general public. Admit when you have made a mistake or do not know the information. Promise to seek out the answers as soon as possible. Outreach to the public and distribution of information can be accomplished through a variety of ways, including the use of technologies such as the Internet. Be aware of the various deadlines for different types of media, such as print, television, and radio.

The JIC structure is most useful when multiple agencies and organizations come together to respond to an emergency or non-emergency and need to provide coordinated, timely, and accurate information to the public and other stakeholders. A JIC Manual has been developed by the NRT and is accessible at www.nrt.org. The model is generic and can be adapted for use in a diverse range of responses likely to be performed by the NRS.

The JIC structure is flexible and designed to expand to accommodate local, state, and federal personnel. JICs range in size from large multiple agency, multiple-hazard response to a small, single agency, single-hazard response. At a minimum, the following functions would be staffed:

- Information Officer (I/O),
- Assistant IO/JIC Manager,
- Assistant IO for Internal Affairs (additional positions for data gathering and production assistant), and
- Assistant IO for External Affairs (additional position for dissemination tasks)

9.2 Checklists for Emergency Communications

Effective emergency communications requires that communicators be prepared, available, and credible. Planning ahead will help you deal with surprise, rumors, erroneous media stories, and increased outside scrutiny. Before emergency communicators arrive on-scene, they should:

✓ Make a list of names and phone numbers you will need, such as the contact person on-scene and key agency contacts, the head of emergency response, your external affairs director and congressional liaison, and the state coordinator.

✓ Make a list of activities that must be accomplished to ensure that information reaches the demographically diverse populations identified within the impacted community.

✓ Monitor media coverage of the event and develop a checklist for things to include in the public outreach messages that will be generated by the JIC.

✓ Assemble equipment and supplies you will need, such as a laptop computer (with wireless access to the Internet), printer, cell phone, backup communication systems (e.g., two-way radios or satellite communications), camera (preferably digital), office supplies and personal safety gear. Do not forget to bring power cords, extra batteries, and film.

✓ Also bring other key items such as credentials and forms, electronic templates for letterhead and news releases, bank cards, maps (including mapping software such as GIS and digital maps such as Rand McNally Tripmaker), and a local phone book.

Once you arrive on scene:

✓ Integrate into existing response structures and the JIC. Introduce yourself to the IC, Command Staff, and others as appropriate.

✓ Participate in the development of a public communications strategy. A communications strategy for an anthrax response should answer the following key questions:

- Who are the individuals and organizations impacted by the contamination?
- What are the specific areas and populations thought to be affected and what are the surrounding areas and populations that are not affected?
- What are the key communications issues that need to be addressed?
- What are the key messages the response team needs to convey to the public?
- How will the response team communicate with the community, local officials, and the media?
- How are the various response entities organized for an efficient and effective response?

These questions should be answered before any effective communications or outreach activity is implemented. Answers may be obtained informally through discussions with key responders, community members, news media, and other key organizations.

✓ Identify and meet with community leaders and media to receive input on developing an integrated emergency communications and outreach strategy.

✓ Consider scheduling a press briefing twice a day and make sure the Incident Commander and Command Staff knows when and where they are. Make sure that all involved agencies participate in the briefings as appropriate. The press will probably want to talk to a technical person closest to the action. Be prepared talk to the press throughout the day, but scheduled briefings will provide the same information to everyone at once.

✓ Arrange for and publicize a toll-free phone number for residents and media to call for information.

✓ Attend all multi-agency meetings. Agencies in small towns may need help and advice. Be prepared for agencies with sensitive issues, unique agendas, and specific constraints.

✓ Clear any information with the organizations that may be impacted by the public response before advising the public. For example, check with local hospitals and health officials before advising the community to seek care at the hospital emergency department.

✓ Ensure information is reaching diverse populations identified within the impacted area.

✓ Continue to monitor media coverage of the event and develop a checklist for things to be included in the public outreach messages that will be generated by the JIC. Correct any misinformation promptly.

✓ Follow all the safety rules and wear appropriate safety gear.

✓ Clear any appeal for public assistance. Sometimes the response is overwhelmed to the extent that personnel have to be diverted from the emergency response to process volunteer or donated assistance.

✓ Collate and archive common questions and answers from the incident that can be used to respond to future incidents.

9.3 Suggestions for Communicating Risk

Risk communication is based on the concept that "perception is reality." Perceived risks must be taken seriously and risk communicators must be sympathetic, frank, and accessible to inquirers. Before getting into technical discussions, always show concern for victims and their families.

It is important to know the audience because different audiences (e.g., employees, reporters, local politicians) may need different types of information. Anticipate what information people need and in what form; do not just pass on everything you know. Use language your audience will understand. Avoid jargon and terms of art that may be confusing to the general public. For example, to scientists, using a conservative model to estimate risk provides an extra measure of caution to ensure safety. To many people, a conservative model might imply a limited effort or a desire to preserve the status quo. To scientists, contaminant levels well below standards are considered to be safe; to the general public, the term "below standards" means low quality or unacceptable. Respond to people's concerns about their personal risk. Put data in perspective and try to express risk in different ways. Use comparisons that put risks in perspective.

Remember that often times a local official will have more credibility within a community. Therefore, it may be helpful to enlist such individuals to serve as spokespersons for various issues. For example, involve a local medical person in communicating risk about public health concerns. It is also important to remember that, although individual spokespersons are helpful in communicating particular risks, it is critical that the UC presents a uniform message through the JIC.

9.4 Community Involvement Tools and Activities

Community involvement and public outreach during an anthrax response may present special challenges because of the time constraints, the potential involvement of multiple agencies and organizations, and the limited availability of resources. Regardless, successful community involvement and outreach can be planned and implemented during emergencies. This section provides suggestions for preparing and implementing a community involvement process during an anthrax response.

Assemble a community involvement toolkit in advance, including:

- ✓ Electronic templates for communication strategy, press releases, and fact sheets;
- ✓ Checklist of outreach activities to perform at the incident;
- ✓ Media contacts and messages;
- ✓ Community contacts;
- ✓ Key agency contacts; and
- ✓ List of equipment and materials needed for a field office (computers, printers, fax, office supplies, mobile phones, telephones, etc.).

Develop a community involvement strategy that looks at the community's demographics, identifies community leaders within each demographic group, and brings them together before an event occurs to develop a plan that would address the information needs and concerns of the entire community following an emergency. Examples of appropriate community involvement activities:

- ✓ Designate an official spokesperson,
- ✓ Call ECOT or PIAT for backup (see Section 9.5 below),
- ✓ Notify affected community quickly,
- ✓ Establish an information repository,
- ✓ Establish 1-800 telephone line,
- ✓ Conduct public availability sessions/public meetings (e.g., town-hall meeting),
- ✓ Establish a JIC (see Section 9.1 above),
- ✓ Go door-to-door to keep community informed, and
- ✓ Create easy-to-read public outreach materials (e.g., fact sheets, maps, etc.).

9.5 Assistance from Special Teams

Special Teams are available to assist federal agencies in emergency communications, community involvement, and outreach. This section describes what they are and how to reach them for assistance.

The Superfund Emergency Communications and Outreach Team (ECOT)

The Emergency Communications and Outreach Team (ECOT) supports EPA regional emergency responses, specifically during national disasters and other significant events that require public outreach for extended periods of time. ECOT is a resource for building trust and credibility in the community. Its members are experienced Superfund community involvement and public affairs specialists. They allow OSCs to stay focused on the response by assisting with communications issues. ECOT members can travel to the incident and support or lead communication efforts on-scene or they may consult by phone or email to suggest strategies for effective community interaction. For additional information, contact Helen DuTeau at (703) 603-8761 or duteau.helen@epa.gov

U.S. Coast Guard Public Information Assist Team (PIAT)

The Public Information Assist Team (PIAT) consists of four emergency communications professionals who are available to federal OSCs during incidents receiving high media or public attention. Their primary function is to support emergency communications during accidental or premeditated releases of oil or hazardous materials. This specialized team is also deployed to airplane crashes, floods, hurricanes, and incidents involving weapons of mass destruction.

PIAT members are qualified to set up a JIC and fill the IO, Assistant IO, and JIC Coordinator positions during a major event. The team can be deployed on two hours notice and will bring all equipment needed to establish and fully operate a JIC. They provide Incident Commanders with public information strategies, skills, and risk communications tools to help inform the public and media. For more information, contact SCPO Tod Lyons at (252) 331-6000, X3025 or CWO Gene Maestas at X3028 or e-mail at: tlyons@nsfcc.uscg.mil; gmaestas@nsfcc.uscg.mil.

APPENDIX A:
Quick Response Guide

TO BE ADDED

APPENDIX B:
Example PPE Ensembles

APPENDIX B:
Example PPE Ensembles

PPE selection should be determined by an assessment of risk. To assist with this determination, the following zones have been developed to offer basic advice and suggest protective measures. The zones are:

Green Zone - Workplaces where contamination with *B. anthracis* spores is unlikely.

This zone covers the vast majority of workplaces in the United States since *B. anthracis* spores have only been discovered in a very limited number of workplaces. The release of *B. anthracis* spores in these workplaces is not considered a credible threat.

If there is a substantial question if a credible threat exists as to an anthrax release in a workplace, that workplace should be considered as a yellow risk zone.

Yellow Zone - Workplaces where contamination is possible.

Risk factors that should be considered in this zone include the handling of bulk mail, handling mail from facilities that are known to be contaminated, working near equipment such as high-speed processors/sorters that could aerosolize *B. anthracis* spores, workplaces in close proximity to other workplaces known to be contaminated, or workplaces that may be targets of bio-terrorists. Assessment of the threat credibility for target workplaces is based upon factors such as historical precedent, technical difficulty, willingness of perpetrator, and target vulnerability.

Example worksites include:

- Postal facilities servicing high profile government worksites, such as:
  - Post offices,
  - Mail distribution/handling centers,
  - Bulk mail centers,
  - Air mail facilities,
  - Priority mail processing centers,
  - Public and private mailrooms and postal service businesses, and
  - Any other setting where handling and processing of mail occurs;
- Large gathering places of national interest;
- High-profile government agencies;
- Credible threat locations, including national security events; and
- Worksites that receive a letter with unknown substance and note stating "Exposure to Anthrax."

Red Zone - Workplaces where contamination has been confirmed or is strongly suspected.

This zone includes the following situations: (1) The employer is notified by law enforcement or public health authorities that a facility is either confirmed through sampling as having been contaminated with *B. anthracis* spores or is strongly suspected because of the presence of disease, or (2) the employer is engaged in emergency response to and clean-up of bio-terrorist releases of

B. anthracis. NOTE: After decontamination and post-decontamination sampling, the previously contaminated workplace returns back to the appropriate risk zone (yellow or green).

Examples of PPE ensembles based upon the above risk zones are presented below. These examples are based upon experience with contaminated workplaces which have generally resulted from contact with or dispersal of *B. anthracis* spores from a letter or package. The examples also provide guidance on controlling the spread of *B. anthracis* spores from potentially contaminated PPE. The following specific scenarios are presented:

- Initial Entry and Sampling in a Red Risk Zone,
- Initial Entry and Sampling in a Yellow Risk Zone,
- Initial Entry into a Green Risk Zone,
- Clean-up Activities,
- Post Cleanup Sampling, and
- Transitional Program Sampling.

Initial Entry and Sampling in a Red Risk Zone

This sampling will usually occur in a containment area (i.e., exclusion zone) after the source of contamination and the area have been secured. Because there is positive indication of contamination (hence the Red Zone designation), a decontamination line is included in the Personnel Decontamination Program for the site. This scenario also applies to aggressive "All Clear" sampling.

Skin Protection Equipment

- Single, uncoated Tyvek or equivalent coveralls with hood and feet (Note: Taping the openings is recommended.)
- A comfortable inner clothing layer, such as disposable hospital scrub suits or non-disposable underclothes laundered by the employer.
- Inner and outer disposable gloves.

Respiratory Protection Equipment

- A full-face, air purifying respirator (APR) with N95 filters for personnel who are protected by prophylactic medical treatment (e.g., vaccination or antibiotics), or
- A full-face, powered air purifying respirator (PAPR) with P100 filters. This option is recommended.

Other Safety PPE

Other safety equipment (e.g., hearing protection, safety shoes, fall protection, etc.) may be required as specified in the Health and Safety Plan to protect personnel from hazards other than anthrax spores. Unnecessary PPE should not be worn.

Contamination Containment Procedures

A Personnel Decontamination Program should be implemented to prevent secondary contamination from the PPE. A multi station personal decontamination line must be established for personnel and tools leaving the contaminated area. Below are example elements:

- Over-booties are used to prevent tracking contamination between sampling sites within the building and provide additional protection from abrasion to the primary PPE coveralls.
- For obvious gross contamination of dirt, it is recommended that the outer layer be HEPA vacuumed prior to proceeding to other areas of the building and before doffing.
- When sampling is completed, all workers must exit the contaminated area at the designated location (i.e., personnel decontamination line).
- In the first chamber of the personnel decontamination line, while leaving the respirator in place, remove outer and inner garments inside-out and place in bags. Dispose or decontaminate PPE as specified in the Personnel Decontamination Program.
- Proceed to shower while wearing respirator.
- Clean respirator first, then shower body and hair.
- Exit shower and proceed to clean side and don street clothes.

- Disposable PPE can be disinfected on site by immersing them into decontaminating/disinfecting barrels. After sufficient contact time, the disposable PPE can be disposed of as non-infectious waste as prescribed in the Chapter 8.
- Respirators must be decontaminated/disinfected (e.g., with soap and water) before reuse. Filters can be reused during the same day if capped or taped securely to prevent transfer or release of contamination.

Initial Entry and Sampling in a Yellow Risk Zone

This sampling will often occur in the presence of workers who are not wearing any PPE. The PPE used by the sampling personnel is justified because they will be entering dusty locations where workers normally do not occupy (e.g., HVAC systems, exhaust dust traps) and they may be conducting aggressive surface sampling.

- Personnel must have access to immediate medical care if sample results are positive or if they develop signs of anthrax disease. See Chapter 5, Health and Safety Considerations.

Skin Protection Equipment

- Single, un-coated Tyvek or equivalent coveralls with hood and feet (Note: Taping the openings is optional).
- A comfortable inner clothing layer, such as disposable hospital scrub suits or non-disposable underclothes laundered by the employer, as prescribed in the Chapter 5.
- Inner and outer disposable gloves.

Respiratory Protection Equipment

- A full-face, APR with N95 filters is acceptable, particularly if personnel are protected by prophylactic medical treatment (e.g., vaccination or antibiotics).
- A full-face, powered air purifying respirator (PAPR) with P100 filters is recommended.
- Some first responders may utilize SCBA as part of their normal "Hazmat" response ensemble. See Chapter 4, First Response for more information.

Other safety PPE

Other safety equipment (e.g., hearing protection, safety shoes, fall protection, etc.) may be required as specified in the Health and Safety Plan to protect personnel from hazards other than anthrax spores. Unnecessary PPE should not be worn.

Contamination Containment Procedures

A Personnel Decontamination Program should be implemented to prevent secondary contamination from the PPE. Below are example elements:

- Booties may be used to prevent tracking contamination between sampling sites within the building and provide additional protection from abrasion of the primary coveralls.

- For obvious gross contamination of dirt, it is recommended that the outer layer be HEPA vacuumed prior to proceeding to other areas of the building, and before doffing.
- When sampling is completed, workers must remove their outer PPE inside-out and place it in a bag.
- Workers then proceed to a changing area to remove and bag scrubs or underwear, and shower. If a shower is not available, personnel should wash hands, face, arms and don street clothes and then shower as soon as practical.
- The bagged disposables should be held pending sampling results. If the results are positive, they need to be treated as potentially infectious waste. One alternative is to immerse the disposables in a disinfecting solution on-site so that they can be disposed of as general waste. Non-disposable underwear can handles as prescribed in the Chapter 8.
- Respirators must be decontaminated (e.g., with soap and water) before reuse. Filters can be reused during the same day if capped or taped securely to prevent transfer or release of contamination.

Initial Entry and Sampling in a Green Risk Zone

This activity will occur where it is unlikely that *B. anthracis* spores are present due to the type or activity of the facility -- i.e., it is not an expected "target" for bioterrorism or considered as a credible threat for anthrax release.

- Personnel must have access to immediate medical care if sample results are positive or if they develop signs of anthrax disease. See Chapter 5, Health and Safety Considerations.

Skin Protection Equipment

- Disposable or cloth coveralls which will be bagged pending sample results.
- Disposable gloves if bulk or wipe samples are to be taken.

Respiratory Protection Equipment

- At a minimum, half-face APR with N95 filters while sampling.
- Some first responders may utilize SCBA as part of their normal "HazMat" response ensemble. See Chapter 4, First Response for more information.

Other safety PPE

Other safety equipment (e.g., hearing protection, safety shoes, fall protection, etc.) may be required as specified in the Health and Safety Plan to protect personnel from hazards other than anthrax spores. Unnecessary PPE should not be worn.

Contamination Containment Procedures

- Booties may be used to prevent tracking contamination outside the suspect area within the building and as additional protection from abrasion to the primary coveralls.
- When the entry is completed, workers will remove coveralls and outer PPE inside-out and place in a bag.
- Personnel should wash exposed skin (e.g., hands, face, and neck) thoroughly with soap and water.

- The bagged disposables should be held pending sampling results. If the results are positive, they need to be treated as potentially infectious waste and treated as prescribed in the Site Control Chapter. One alternative is to immerse the disposables in a disinfecting solution on-site so that they can be disposed of as general waste. Non-disposable underwear can be handled as prescribed in the Chapter 8.
- Respirators must be decontaminated (e.g., with soap and water) before reuse. Filters can be reused during the same day if capped or taped securely to prevent transfer or release of contamination.

Clean-up Activities (Liquid)

These activities occur in a containment area (i.e., exclusion zone). Because there is positive indication of contamination (hence the Red Zone designation), a decontamination line is included in the Personnel Decontamination Program for the site.

Skin Protection Equipment

- Single, Tyvek or equivalent coveralls with hood and feet (Note: Taping the openings is recommended.)
- A comfortable inner clothing layer, such as disposable hospital scrub suits or clothes laundered on-site.
- Inner and outer disposable gloves.
- Splash protection equipment such as aprons and gauntlet gloves if the cleaning agent is corrosive or toxic to or through the skin. Chemical coated Tyvek or equivalent may also be used for splash protection, but this may subject the worker to additional heat stress hazards which must be addressed.

Respiratory Protection Equipment

- A full-face, APR with N95 filters for personnel who are protected by prophylactic medical treatment (e.g., vaccination or antibiotics) and the cleanup is using liquid agents. Combination filters (N95 + a filter to protect against the cleaning agent and/or substances produced from the cleaning agent) must be used if the cleaning agent is toxic or produces toxic substances during use.

  or

- A full-face, PAPR with P100 filters or combination filters (P100 + a filter to protect against the cleaning agent and/or substances produced from the cleaning agent) must be used if the cleaning agent is toxic or produces toxic substances during use. The use of PAPRs is recommended.

  or

- A positive pressure SCBA if the exposures to the cleaning agent (e.g., Chlorine dioxide or formaldehyde) are above the Assigned Protection Factor (APFs) of the filtered respiratory protection.

Other Safety PPE

Other safety equipment (e.g., hearing protection, safety shoes, fall protection, etc.) may be required as specified in the Health and Safety Plan to protect personnel from hazards other than anthrax spores. Unnecessary PPE should not be worn.

Contamination Containment Procedures

A Personnel Decontamination Program should be implemented to prevent secondary contamination from the PPE. A multi-station personal decontamination line must be established for personnel and tools leaving the contaminated area. Below are example elements:

- Over-booties are used to prevent tracking contamination between sampling sites within the building and provide additional protection from abrasion to the primary PPE coveralls.
- For obvious gross contamination of dirt, it is recommended that the outer layer be HEPA vacuumed prior to proceeding to other areas of the building and before doffing.
- When sampling is completed, all workers must exit the contaminated area at the designated location (i.e., personnel decontamination line).
- In the first chamber of the personnel decontamination line, while leaving the respirator in place, remove outer and inner garments inside-out and place in bags. Dispose or decontaminate PPE as specified in the Personnel Decontamination Program.
- Proceed to shower while wearing respirator.
- Clean respirator first, then shower body and hair.
- Exit shower and proceed to clean side and don street clothes.
- Disposable PPE can be disinfected on site by immersing them into decontaminating / disinfecting barrels. After sufficient contact time, the disposable PPE can be disposed of as non-infectious waste as prescribed in Chapter 8. Non-disposable underwear is handled as prescribed in Chapter 8.
- Respirators must be decontaminated (e.g., with soap and water) before reuse. Filters can be reused during the same day if capped or taped securely to prevent transfer or release of contamination.

Clean-up Activities (Fumigation)

These activities occur in a containment area (i.e., exclusion zone). Because there is positive indication of contamination (hence the Red Zone designation), a decontamination line is included in the Personnel Decontamination Program for the site.

Skin Protection Equipment

- Single, Tyvek or equivalent coveralls with hood and feet (Note: Taping the openings is recommended.)
- A comfortable inner clothing layer, such as disposable hospital scrub suits or clothes laundered on-site.
- Inner and outer disposable gloves.
- Splash protection equipment such as aprons and gauntlet gloves if the cleaning agent is corrosive or toxic to or through the skin. Chemical coated Tyvek or equivalent may also be used for splash protection, but this may subject the worker to additional heat stress hazards which must be addressed.

Respiratory Protection Equipment

- For entry before fumigation is begun or after fumigant levels have been reduced to a level where APR's can be used, a full-face APR with N95 filters for personnel who are protected by prophylactic medical treatment (e.g., vaccination or antibiotics), and the cleanup is using liquid agents. Combination filters (N95 + a filter to protect against the cleaning agent and / or substances

produced from the cleaning agent) must be used if the cleaning agent is toxic or produces toxic substances during use.

or

- For entry before fumigation is begun or after fumigant levels have been reduced to a level where APR's can be used, a full-face, PAPR with P100 filters or combination filters (P100 + a filter to protect against the cleaning agent and / or substances produced from the cleaning agent) must be used if the cleaning agent is toxic or produces toxic substances during use. The use of PAPRs is recommended.

or

- A positive pressure SCBA, if the entry is made during fumigation and before the fumigant levels have been reduced to below the level where APRs can be used.

Other Safety PPE

Other safety equipment (e.g., hearing protection, safety shoes, fall protection, etc.) may be required as specified in the Health and Safety Plan to protect personnel from hazards other than anthrax spores. Unnecessary PPE should not be worn.

Contamination Containment Procedures

A Personnel Decontamination Program should be implemented to prevent secondary contamination from the PPE. A multi station personal decontamination line must be established for personnel and tools leaving the contaminated area. The following provides example elements:

- Over-booties are used to prevent tracking contamination between sampling sites within the building and provide additional protection from abrasion to the primary PPE coveralls.
- For obvious gross contamination of dirt, it is recommended that the outer layer be HEPA vacuumed prior to proceeding to other areas of the building and before doffing.
- When sampling is completed, all workers must exit the contaminated area at the designated location (i.e., personnel decontamination line).
- In the first chamber of the personnel decontamination line, while leaving the respirator in place, remove outer and inner garments inside-out and place in bags. Dispose or decontaminate PPE as specified in the Personnel Decontamination Program.
- Proceed to shower while wearing respirator.
- Clean respirator first, then shower body and hair.
- Exit shower and proceed to clean side and don street clothes.
- Disposable PPE can be disinfected on site by immersing them into decontaminating/disinfecting barrels. After sufficient contact time, the disposable PPE can be disposed of as non-infectious waste as prescribed in the Chapter 8. Non-disposable underwear is handled as prescribed in the Chapter 8.
- Respirators must be decontaminated (e.g., with soap and water) before reuse. Filters can be reused during the same day if capped or taped securely to prevent transfer or release of contamination.

Notes to the Scenarios:

- In the recommendations for PPE, it should be noted that the recommended respiratory protection from an unidentified level of contaminant, without warning properties, is an air-powered purifying respirator (PAPR). It is understood that this is contrary to the general NIOSH respirator decision logic. In these cases, a risk assessment of the PPE, the biohazard, the job tasks, and the possible prophylactic precautions leads to the permissible use of PAPRs in these circumstances.

- Loose-fitting PAPRs (those with a hood rather than a tight-fitting face piece) have lower protection factors and are equivalent to non-powered APRs in their protection. Their advantage is reduction of physiological and heat stress factors during use and more protection of the face, head, and neck from contamination.

- It is recommended that workers exposed to *B. anthracis* spores shower on site after removing their PPE and before donning their clean clothing.

- Each person who wears a tight-fitting face piece respirator must be fit tested to determine that the appropriate protection factor is attained. A quantitative fit test is preferred although only a qualitative test is required.

- Negative pressure APR seal checks should be performed by the wearer before each use. Random seal checks with an irritant smoke challenge can be made to assess the quality of the seal.

- Additional equipment may be required to preserve the integrity of the PPE during activities where the PPE can become abraded, cut, or otherwise damaged. This equipment may include knee and elbow pads, hard hats, leather overgloves, and overboots.

APPENDIX C:
Decontamination Fact Sheets

Fact Sheet - Sodium Hypochlorite (liquid)

For use in *Bacillus anthracis* decontamination

Mechanism of Toxicity	Sodium hypochlorite (NaOCl) is a liquid antimicrobial agent that stimulates germination of *Bacillus anthracis* spores and oxidizes (disrupts) certain enzymes and/or amino acids.
Application Method	Available products: Several hundred registered sodium hypochlorite products. Area preparation: Isolation and pre-cleaning of treatment area. Application: Sodium hypochlorite can be deployed as a spray, liquid, fog, or aerosol. Product efficacy is dependent on specific conditions including room temperature (68 °F), pH (7), low organic load, concentration (5,250 to 6,000 ppm), and contact time (60 minutes). A mixture of 1 part bleach (5.25% to 6.0%) to 1 part white vinegar to 8 parts water is recommended. Removal: Remove product by wiping treated area with sterilized cloths. Additional procedures: A detailed SOP for the application of sodium hypochlorite is available from the EPA Environmental Response Team Center, Edison, NJ.
Application Site	Clean, hard surfaces
Prior Applications	Used to decontaminate offices and USPS facilities in Washington, D.C., New York, New Jersey, and Florida
Properties of Chemical	CAS Number: 7681-52-9 Odor: chlorine Human hazards: undiluted product is extremely irritating to eyes/skin; no evidence of chronic effects. Corrosivity: corrosive to certain metals Stability: stable until diluted for application; use on same day. Storage: store in opaque container away from light Ecological effects: highly acutely toxic in concentrated form to freshwater fish and invertebrates
EPA Registration Status	Crisis exemption issued 2/14/02. See www.epatechbit.org.
Further Information	Refer to fact sheet on www.epa.gov/epahome/hi-anthrax.htm.

Fact Sheet - Chlorine Dioxide (Gas)

For use in *Bacillus anthracis* decontamination

Mechanism of Toxicity	Chlorine dioxide (ClO_2) gas is an antimicrobial agent that kills *Bacillus anthracis* spores by cell lysis (dissolution) and oxidation (disruption) of certain amino acids and enzymes.
Application Method	Available products: Registered and unregistered products containing sodium chlorite as the active ingredient. Area preparation: Isolation of treatment area, including sealing all doors, windows, and vents, for control of gas exchange and elimination of UV or visible light sources. Application: Temperature, humidity, and chlorine dioxide concentration must be strictly maintained for specific time period. Gas will reach both potentially aerosolized spores and hard to reach surfaces including porous and non-porous surfaces. Bacterial spore strips are installed in tactical locations to evaluate efficacy of the fumigation. Air monitoring sites are established internal and external to the treatment area. Removal: Chlorine dioxide is removed via venting or scrubbing. Treatment may leave a fine residue, but it is not toxic. Additional procedures: A detailed SOP for the application of chlorine dioxide gas is available from the EPA Environmental Response Team Center, Edison, NJ.
Application Site	This product may be used when anthrax spores are at high concentrations or potentially aerosolized, when the treatment area can be completely isolated, and for both porous and non-porous surfaces, provided that enough space between objects exists to allow for complete circulation of gas.
Prior Applications	Used to decontaminate offices in Washington, D.C.
Properties of Chemical	CAS Number: 10049-04-4 Odor: chlorine Human hazards: irritating to eyes, nose, throat; limited available data on chronic effects; not tested for carcinogenicity in animals. Stability: highly reactive with organic substances Explosive limit: 100,000 ppm Storage: gas cannot be stored; it must be generated on-site from precursor components (e.g., sodium chlorite). Drinking water standard: 0.8 mg/l OSHA PEL: 100 ppb, 8-hr TWA
EPA Registration Status	Crisis exemption issued 11/30/01for use in the Hart Senate Office Building. See www.epatechbit.org.
Further Information	Refer to fact sheet on www.epa.gov/epahome/hi-anthrax.htm. Refer to EPA IRIS database at www.epa.gov/iris/subst/0496.htm.

Fact Sheet - Chlorine Dioxide (Aqueous)

For use in *Bacillus anthracis* decontamination

Mechanism of Toxicity	Aqueous chlorine dioxide (ClO_2) is chlorine dioxide gas dissolved in water. It is an antimicrobial agent that kills *Bacillus anthracis* spores by cell lysis (dissolution) and oxidation (disruption) of certain amino acids and enzymes.
Application Method	Available products: Registered and unregistered products containing sodium chlorite as the active ingredient. Area preparation: Isolation of treatment area. Application: Aqueous ClO_2 can be made from liquid components using a ClO_2 generator, through dry formulation hydrated to solution, or through acidification of a sodium chlorite solution. The potency of the chlorine dioxide solution depends upon the concentration of gas dissolved in solution. Therefore, a gentle application with the least amount of gas volatilization is preferred such as wiping on by hand or spraying with low pressure and maximum droplet size. To aid in gas retention, sodium chlorite and Triton DF 12 may be added to the formulation. The surface must remain wet throughout the required contact time – 30 minutes – thus, multiple applications may be necessary. A concentration of 500 ppm chlorine dioxcide in solution must be achieved. The treatment area must also remain dark because contact with ultraviolet (UV) radiation increases the rate of decay of chlorine dioxide and renders it less potent. Finally, the surfaces should be room temperature (68 ^{o}F) and the on-site generated solution should be used immediately in a manner that maximizes ClO_2 retention. Removal: After the 30 minute contact time, surfaces should be allowed to air dry (not wiped). Treatment may leave a fine residue, but it is not toxic. Additional procedures: A detailed SOP for the application of chlorine dioxide is available from the EPA Environmental Response Team Center, Edison, NJ.
Application Site	Clean, hard surfaces.
Prior Applications	Used to decontaminate offices in Washington, D.C.

Properties of Chemical	CAS Number: 10049-0404 Odor: chlorine Human hazards: Irritating to eyes, nose, throat; no evidence of chronic effects. Corrosivity: minimal corrosivity with pure solution Stability: highly reactive Explosive Limit: 100,000 ppm Storage: cannot be stored; must be generated on-site from precursor components. Drinking water standard: 0.8 mg/L OSHA occupational exposure limit: 0.1 ppm, 8 hour time-weighted average.
EPA Registration Status	Crisis exemption issued 11/09/01; amended 12/18/01 and 3/28/02. See www.epatechbit.org.
Further Information	Refer to fact sheet on www.epa.gov/epahome/hi-anthrax.htm.

Fact Sheet - Ethylene Oxide (Gas)

For use in *Bacillus anthracis* decontamination

Mechanism of Toxicity	Ethylene oxide (EtO) gas is an antimicrobial agent that penetrates *Bacillus anthracis* spore walls and destroys nucleic acids by alkylation.
Application Method	Available products: Registered ethylene oxide products. Preparation: Items to be treated must be pre-conditioned (i.e., exposed to the elevated temperature and humidity levels required for treatment). Application: Primary conditions that affect sterilization include temperature, humidity, contact time, air convection and load configuration. Ethylene oxide is potentially incompatible with rubber, plastics, and certain organic-based coatings. Removal: Ethylene oxide is pumped out of the treatment chamber. Items must be adequately aerated so that less than 1 ppm remains in air (i.e., the OSHA occupational inhalation workplace standard, 8 hour time-weighted average).
Application Site	Ethylene oxide sterilization is carried out in a sterilization system that may be fixed or portable.
Prior Applications	Used to treat individual items or mail that have been contaminated or potentially contaminated with *Bacillus anthracis* (Richmond, VA and McLean, VA), or for testing purposes (Erie, PA and Nogales, AZ).
Properties of Chemical	CAS Number: 75-21-8 Odor: colorless, odorless gas at room temperature Human hazards: classified by EPA as a probable human carcinogen; mutagenic and teratogenic. Special training and medical monitoring are required. Corrosivity: minimal corrosivity Reactivity: reacts with water to form ethylene glycol Explosive Limit: flammable and explosive above 3.6% Storage: liquid under pressure OSHA occupational exposure limit: 1 ppm (8 hour time weighted average)
EPA Registration Status	Crisis exemptions issued 12/7/01, 12/17/01, 1/3/02, 1/9/02, and 2/26/02. See www.epatechbit.org.
Further Information	Refer to fact sheet on www.epa.gov/epahome/hi-anthrax.htm.

Fact Sheet - Paraformaldehyde

For use in *Bacillus anthracis* decontamination

Mechanism of Toxicity	Paraformaldehyde powder or flakes (prills), de-polymerized by heat, produce formaldehyde gas, which kills *Bacillus anthracis* spores.
Application Method	Available products: Unregistered paraformaldehyde prills, manufactured by Hoechst-Celanese, containing 95% paraformaldehyde. Area preparation: Isolation of treatment area. Application: Paraformaldehyde is heated to allow de-polymerization and the production of formaldehyde gas. Efficacy is influenced by concentration, temperature, and humidity, which must be maintained throughout required contact time of 16 - 18 hours. Formaldehyde is incapable of penetrating grease or oil deposits and dense absorptive material. Removal: Formaldehyde is neutralized by ammonium bicarbonate and removed via venting/aeration.
Application Site	Small or large treatment area with non-porous materials that can be completely isolated with enough space to allow for circulation of gas.
Prior Applications	Used as a space decontaminant in New York, USAMRIID (Fort Detrick), NIH, CDC, USDA, and other locations throughout the world.
Properties of Chemical	CAS Number: 30525-89-4 Odor: pungent, suffocating odor Human hazards: irritating to eyes, nose, throat; probable human carcinogen; genotoxic; no known occupationally acquired illness has been documented following facility decontamination and reuse Corrosivity: non-corrosive
EPA Registration Status	Crisis exemptions issued 1/30/01 and 2/14/02. See www.epatechbit.org.
Further Information	Refer to fact sheet on www.epa.gov/epahome/hi-anthrax.htm and to EPA IRIS database at www.epa.gov/iris/subst/0419.htm.

Fact Sheet - High Efficiency Particulate Air (HEPA) Filter Vacuuming

For use in *Bacillus anthracis* decontamination

Mechanism of Toxicity	Use of a high efficiency particulate air (HEPA) filter vacuum reduces, and in some instances may eliminate, *Bacillus anthracis* spores by removal.
Application Method	Area preparation: Isolation of treatment area. Application: HEPA filter vacuum may be used on porous and non-porous surfaces and may be applied to collect spores from a "top to bottom" or "cold to hot" approach. The HEPA filter sock fitted vacuum is applied to the contaminated area beginning with the outer edge of the contaminated area, working inward. Vacuuming of all surfaces should be conducted at an extremely slow and controlled rate to minimize dispersion of potentially contaminated dust during the vacuuming process. Work also progresses from ceiling to floor. Removal: Vacuum filters must be disposed of in accordance with federal, state and local laws. Additional procedures: A detailed SOP for HEPA vacuuming is available from the EPA Environmental Response Team Center, Edison, NJ.
Application Site	Treatment area can be isolated with adequate space for vacuuming. Porous and non-porous surfaces can be vacuumed, with anticipated removal of surface contamination only.
Prior Applications	Used to decontaminate offices in Washington, D.C. and in numerous USPS facility decontamination projects.
Properties of Chemical	Not applicable
EPA Regulatory Status	Not applicable

Fact Sheet - Irradiation

For use in *Bacillus anthracis* decontamination

Mechanism of Toxicity	Items are exposed to ionizing radiation as a means to destroy *B. anthracis* spores and bacteria. Irradiation causes irreparable damage to cellular DNA.
Application Method	Irradiation of contaminated items has been implemented and completed in off-site locations only. Irradiation can be damaging to items such as pharmaceuticals, medical samples, lenses, magnetic storage media, etc. both through direct irradiation effects and high temperatures - lists of such items are available.
Application Site	Off-site treatment facility: in-line electron beam irradiators have been designed and implemented for addition to sorting machines in postal facilities.
Prior Applications	Electron beam and X-ray irradiation facilities in Ohio and New Jersey (mail). Gamma irradiation of food and medical equipment (not specifically for *B. anthracis*) is routinely accomplished at many facilities.
Properties of Chemical	Gamma rays come from cobalt 60 or cesium 137 sources X-rays and e-beams from machine sources.
EPA Regulatory Status	EPA does not have regulatory authority over irradiation as it is governed under the FDA's medical instrument regulations. For current status refer to www.epatechbit.org

Fact Sheet - Hydrogen Peroxide and Peroxyacetic Acid

For use in *Bacillus anthracis* decontamination

Mechanism of Toxicity	Both hydrogen peroxide (H_2O_2) and peroxyacetic acid are known as peroxy compounds, which are microbiocides. Products containing a mixture of chemicals are registered as sterilants and are capable of killing *B. anthracis* spores through oxidation.
Application Method	Available products: Oxonia Active (EPA Registration Number 1677-129) containing 27.5% Hydrogen Peroxide and 5.8% Peroxyacetic Acid, and KX-6049 (EPA Registration Number 1677-158) containing 6.9% Hydrogen Peroxide and 4.4% Peroxyacetic Acid. Actril Cold Sterilant (EPA Registration Number 52252-7) and Spor-Klenz Ready to Use (EPA Registration Number 52252-7-1043), both of which contain 0.80% Hydrogen Peroxide and 0.06% Peroxyacetic Acid. Area Preparation: Isolation of treatment area. Application: Oxonia Active and KX-6049 come in a concentrate form that needs to be diluted according to label directions. The recommended rate of application is 5,000 ppm of peroxyacetic acid at room temperature (68 °F) with a contact time of 20 minutes. A rate of 5,000 ppm is achieved by adding 10 oz. Oxonia Active to 1 gal. of water, or 13 oz. KX-6049 to 1 gal. of water. Before applying, surfaces must be precleaned.. Actril Cold Sterilant and Spor-Klenz Ready to Use products are applied without dilution directly to hard surfaces at room temperature (68 °F) with a contact time of 10 minutes. Surface should be temperature and humidity controlled. Concentrate products that are diluted should be made on-site and used during the same day. Ready to use products may be kept in the original container. Removal: Treated area may be air dried after specified contact time.
Application Site	Clean, hard surfaces.
Prior Applications	Not known at this point.
Properties of Chemical	CAS No.: 7722-84-1 (H_2O_2) and 79-21-0 (peroxyacetic acid)
EPA Registration Status	Crisis exemptions issued 2/14/02 and 3/28/02. See www.epatechbit.org.
Further Information	Refer to fact sheet on www.epa.gov/epahome/hi-anthrax.htm